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REPORT

ON THE

SCIENTIFIC RESULTS

OF THE

VOYAGE OF H.M.S. CHALLENGER

DURING THE YEARS 1873-76

UNDER THE COMMAND OF

CAPTAIN GEORGE S. NARES, R.N., F.R.S.

AND THE LATE

CAPTAIN FRANK TOURLE THOMSON, R.N.

PREPARED UNDER THE SUPERINTENDENCE OF

THE LATE

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ZOOLOGY—VOL. XX.

PART LIX.—REPORT ON THE MONAXONIDA

BY STUART O. RIDLEY, M.A., F.L.S., AND ARTHUR DENDY, B.Sc., F.L.S.

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EDITORIAL NOTE.

The Collection of Monaxonida was in the first instance intrusted to Mr. Stuart O. Ridley, F.L.S., of the British Museum, for examination and description.

Mr. Ridley had made very considerable progress in the work when he was compelled, owing to ill health, to inform me that he could not complete the Report within the specified time. In these circumstances I suggested that Mr. Arthur Dendy, B.Sc., F.L.S., should be associated with him in the work, to which proposal Mr. Ridley at once assented. The result has been the present highly satisfactory Memoir on this group of sponges, consisting of about 350 pages, illustrated by 51 lithographic plates, woodcuts, and a map.

The Manuscript was received in instalments between 19th November 1886 and 13th May 1887.

John Murray.

Challenger Office, 32 Queen Street,
Edinburgh, 22*nd July* 1887.

ERRATA.

Page 12, line 19 from top, for "*Schmidtia variabilis*" read "*Petrosia variabilis.*"
Page 17, line 2 from bottom, omit the words "*and from.*"
Page 29, line 21 from top, for "*Tubulodigitus*" read "*Patuloscula*," and *for* "p. 367" *read* "p. 365."
Page 38, lines 9 and 13 from top, for "*Gellius pyriformis*" read "*Gellius* sp."
Page 46, line 10 from bottom, *for* "oxeote" *read* "strongylote."
Page 82, line 15 from bottom, *for* "lat. 48° 30′ 0″ S." *read* "lat. 0° 48′ 30″ S."
Page 102, line 18 from top, and elsewhere, for "*Meliiderma stipitata*" read "*Meliiderma stipitatum.*"
Page 129, line 12 from bottom, for "*Esperinæ*" read "*Esperellinæ.*"
Page 220, line 7 from top, and elsewhere, for "*Trichostemma irregularis*" read "*Trichostemma irregulare.*"
Page 225, line 18 from top, for "*Suberites ramulosa*" read "*Suberites ramulosus.*"
Page 242, line 13 from top, for "*Myxilla plumosa*" read "*Myxilla* (*?*) *plumosa.*"
Page 242, line 15 from top, omit the words "*Plumohalichondria plumosa.*"
Page 243, last line, for "*Cladorhiza tridentata*" read "*Cladorhiza* (*?*) *tridentata.*"

THE

VOYAGE OF H.M.S. CHALLENGER.

ZOOLOGY.

REPORT on the MONAXONIDA collected by H.M.S. Challenger during the Years 1873-76. By STUART O. RIDLEY, M.A., F.L.S., late Assistant in the Zoological Department of the British Museum, and ARTHUR DENDY, B.Sc., F.L.S., Associate of the Owens College, and Assistant in the Zoological Department of the British Museum.

PREFACE.

In presenting this Report it seems desirable to give some explanation with regard to the arrangement of the work. We have always felt strongly the great importance of minute anatomical and histological investigation in describing sponges. Owing, however, partly to the unfavourable condition for histological purposes of a large proportion of the material at our disposal and partly to the limited space of time available for the completion of the work, it has been found impossible to work out the minute anatomy and histology of all the species in the collection. Hence we have found it advisable to investigate in detail some of the leading types only, and to confine our remarks on the subject to a special chapter in the Introduction, making them at the same time rather of a general nature.

We have to express our sincere thanks to Mr. John Murray, the Editor of the Challenger Reports, in the first place for placing so valuable and interesting a collection in our hands, and in the second place for the great indulgence which he has shown us while preparing the Report. We have also especially to thank Professor Flower, F.R.S., Director of the Natural History Department of the British Museum, and

Dr. Günther, F.R.S., the Keeper of the Zoological Department, for the facilities which they have placed at our disposal while working in the Museum, and for the use of the rich national collection, without which it would have been scarcely possible to carry on the work.

We are further under great obligations to Professor A. M. Marshall, F.R.S., of the Owens College, and to the authorities of the Normal School of Science and Royal School of Mines, especially Mr. G. B. Howes, F.L.S., for kind permission to make use of their laboratories and appliances for purposes of anatomical and histological investigation.

With reference to his share in the preparation of this Report Mr. Ridley desires to add the following note :—

"Works like the present, produced by a joint authorship, differ in some respects from those otherwise produced, and I wish to say a few words with regard to my own connection with the Report, and especially to the views expressed in it.

"At the time at which it became necessary for another worker to share the labour in order satisfactorily to complete the work, I had done no more than study as carefully as my somewhat limited time and means allowed the classificatory characters of most of the species, and in a few cases also their minute anatomy and histology, and had decided on the novelty or the nomenclature (in the case of the old species) of most of the forms below treated of. The results thus obtained proved to require considerable modification, and the credit of presenting the work in its present form is mainly due to Mr. Dendy, who has studied afresh all the species and mastered their characteristics, besides undertaking by far the greater part of the labour involved in the 'production' of the Report.

"With regard to theoretical views, where any such are referred to in the following pages, either explicitly or by implication, my own position is that references to 'affinity,' 'genetic relationship,' 'development' 'acquisition,' &c., are only to be taken, so far as I am individually concerned, as convenient methods of expressing the phenomena presented to us, and as involving merely hypothetical interpretations of the processes which may be conceived to have taken place in the past history of these organisms; the theory of evolution appears to me to give an extremely reasonable and very possibly true, but as yet not fully demonstrated explanation of these phenomena, except, perhaps, in the case of some book-species, which ought not to be separated from each other. I hold the view that 'theories are convenient bases on which to group facts,' but further consider that facts acquire an additional interest when they are studied with the object of testing theories, and perhaps attain their greatest importance when it is possible to use them inductively, viz., for the construction or confirmation of general laws."

TABLE OF CONTENTS.

PAGE

INTRODUCTION, v–lxviii

CHAPTER I.—The History of the Monaxonida as a group, v

CHAPTER II.—Anatomy and Histology, and Embryological Notes, xii

CHAPTER III.—The Classification of the Monaxonida, liii

DESCRIPTION OF GENERA AND SPECIES, 1–240

Suborder I. HALICHONDRINA, 1

Family I. Homorrhaphidæ, 1

Subfamily 1. Renierinæ, 1

Halichondria, Fleming, 1

Petrosia, Vosmaer, 9

Reniera, Nardo, 14

Subfamily 2. Chalininæ, 18

Pachychalina, Schmidt, 19

Chalina, Grant, 25

Siphonochalina, Schmidt, 29

Family II. Heterorrhaphidæ, 31

Subfamily 1. Phlœodictyinæ, 31

Rhizochalina, Schmidt, 32

Oceanapia, Norman, 36

Subfamily 2. Gelliinæ, 37

Gellius, Gray, 37

Gelliodes, Ridley, 47

Toxochalina, Ridley, 49

Subfamily 3. Tedaniinæ, 50

Tedania, Gray, 50

Trachytedania, Ridley, 57

Subfamily 4. Desmacellinæ, 58

Desmacella, Schmidt, 58

Subfamily 5. Hamacanthinæ, 59

Vomerula, Schmidt, 59

Family III. Desmacidonidæ, 62

Subfamily 1. Esperellinæ, 62

Esperella, Vosmaer, 62

Esperiopsis, Carter, 76

Cladorhiza, M. Sars, 86

Axoniderma, Ridley and Dendy, 96

PAGE

Family III. Desmacidonidæ.
Subfamily 1. Esperellinæ—*continued.*
Chondrocladia, Wyville Thomson, ... 99
Meliiderma, n. gen., ... 102
Desmacidon, Bowerbank, ... 103
Artemisina, Vosmaer, ... 112
Phelloderma, Ridley and Dendy, ... 113
Sideroderma, Ridley and Dendy, ... 114
Iophon, Gray, ... 116
Amphilectus, Vosmaer, ... 123
Subfamily 2. Ectyoninæ, ... 128
Myxilla, Schmidt, ... 128
Clathria, Schmidt, ... 146
Rhaphidophlus, Ehlers, ... 151
Plumohalichondria, Carter, ... 155
Plocamia, Schmidt, ... 157
Acarnus, Gray, ... 159
Echinoclathria, Carter, ... 159
Agelas, Duchassaing and Michelotti, ... 163
Echinodictyum, Ridley, ... 164
Family IV. Axinellidæ, ... 166
Hymeniacidon, Bowerbank, ... 166
Phakellia, Bowerbank, ... 169
Ciocalypta, Bowerbank, ... 173
Acanthella, Schmidt, ... 176
Axinella, Schmidt, ... 178
Raspailia, Nardo, ... 188
Dendropsis, Ridley and Dendy, ... 191
Thrinacophora, Ridley, ... 193
Suborder II. Clavulina, ... 196
Family I. Suberitidæ, ... 197
Suberites, Nardo, ... 197
Polymastia, Bowerbank, ... 210
Proteleia, Dendy and Ridley, ... 214
Trichostemma, M. Sars, ... 216
Tentorium, Vosmaer, ... 221
Stylocordyla, Wyville Thomson, ... 222
Quasillina, Norman, ... 225
Cliona, Grant, ... 227
Family II. Spirastrellidæ, ... 229
Spirastrella, Schmidt, ... 229
Latrunculia, Bocage, ... 233
GEOGRAPHICAL AND BATHYMETRICAL DISTRIBUTION, ... 241–263
APPENDIX—Synonymy of the Spicular Terminology, ... 264
INDEX, ... 265

INTRODUCTION.

CHAPTER I.—THE HISTORY OF THE MONAXONIDA AS A GROUP.

The Monaxonida comprise by far the most commonly met with and abundant of all sponges. They occur in greater or less profusion in all parts of the world, but are more especially shallow-water forms. They may be collected between tide-marks almost anywhere, and on parts of our own coast are thrown up in great quantities after every gale.

With all these points in favour of the collection of abundant material for study, we might naturally be led to expect that our knowledge of the group would be in a correspondingly satisfactory condition. Yet this is not so. On the contrary, there are few (if any) groups of equal importance in the whole Animal kingdom which have been so little studied and with so little success.

If we seek a reason for this state of things it is to be met with largely in the great and exceptional difficulties which beset all attempts at a satisfactory classification. According to one of our oldest and most experienced workers at sponges, "the subject is actually repulsive from its difficulties;"[1] but we do not, ourselves, take quite such an extreme view of the case.

In the first place it is impossible to classify the group according to external characters, for often the external appearance of one and the same species varies almost indefinitely with its varying surroundings, and often two species, sometimes even of distinct genera, resemble each other so closely that it is impossible to distinguish them with certainty without microscopic examination. Hence nothing could be expected of the days before microscopic research, and, as a matter of fact, we find that nothing of importance was done. In the next place many of the distinguishing characters are so minute and difficult to observe, depending as they do upon the forms of the smaller spicules, that even with the aid of recent improvements in the microscope our best observers have often overlooked or misinterpreted them. Lastly, we must remember the fact that all the Monaxonid sponges which an ordinary observer is likely to meet with appear at first sight very uninteresting, and offer very little inducement to careful study. It is not

[1] Carter, Notes Introductory to the Study and Classification of the Spongida, *Ann. and Mag. Nat. Hist.*, ser. 4, vol. xvi. p. 3.

until we are able to examine them microscopically, after an elaborate and troublesome course of preparation, that the real interest of the sponge, namely, the minute anatomy and histology of the soft parts, shows itself. It is probable that one of the chief causes which have prevented the group from being hitherto almost entirely ignored is the singular beauty of the spicules as "objects for the microscope"; now, however, many observers have taken up the subject from a more scientific point of view, and we may hope for a rapid advance in this department of science.

Only within quite recent times have the Monaxonida begun to have a history of their own apart from the history of sponges at large, and as the latter is a subject which has already been more or less fully treated of by previous authors, such as Schmidt,[1] Vosmaer,[2] and von Lendenfeld,[3] we shall here mention only those facts which bear more directly upon our group.

To Zittel is due the credit of having first separated the Monaxonida from the Hexactinellida and Tetractinellida, as a distinct group of siliceous sponges, under the name Monactinellidæ. This he did in 1878, in his paper Zur Stammegeschichte der Spongien;[4] where he proposes the following classification of the sponges:—

Classe: *Spongiæ* oder *Porifera*.

1. Ordnung: *Myxospongiæ*. Haeck. (Carnosa Cart.).
2. Ordnung: *Ceraospongiæ*. Bronn { (Ceratina Cart.). (Psammonemata Cart.).
3. Ordnung: *Monactinellidæ*. Zitt. Kieselspongien mit einaxigen Nadeln. (Raphidonemata, Echinonemata und Holoraphidota z. Th. Carter).
4. Ordnung: *Tetractinellidæ*. Marshall. Kieselspongien mit ankerförmigen Nadeln oder mit den Nadeln des pyramidalen typus (Holoraphidota z. Th. Carter).
5. Ordnung: *Lithistidæ*. O. Schmidt (Holoraphidota z. Th. Carter).
6. Ordnung: *Hexactinellidæ*. O. Schmidt (Carter).
7. Ordnung: *Calcispongiæ*. Blv. (Calcarea Cart.).

In 1883[5] the name Monactinellidæ was altered by Sollas to Monaxonidæ, as the former implied a wrong idea, viz., that the chief spicules of the group are "monactinal," that is to say, consisting of only a single ray, while they are just as often "diactinal" or composed of two rays diametrically opposite to one another. Both these forms of spicule are, however, "monaxonid," that is to say they have each only one axis, which, in the case of the diactinal forms passes through both the rays. Hence the slight alteration in name appears to be justified. It has been further emended by subsequent writers to "Monaxonida," as "idæ" is the accepted termination for the name of a family.

[1] Spong. Adriat. Meeres, p. 1.
[2] Article Porifera, in Bronn's Klassen und Ordnungen des Thierreichs.
[3] Proc. Linn. Soc. N.S.W., vol. ix. pt. i., p. 122.
[4] Festgabe der philosophischen Facultät zum 50 jährigen Doctorjubiläum des Professor von Siebold, München.
[5] Cassell's Natural History, 1883, vol. vi. p. 326.

It is worth our while to investigate in this place the treatment which the Monaxonida, thus constituted by Zittel as a distinct group of sponges, have met with at the hands of other recent authors.

Commencing with Bowerbank, we find that his classification of sponges has the one advantage of simplicity, though, based as it is almost solely upon the arrangement of the skeleton, without any regard to the anatomy of the soft parts or to the forms of the spicules (except as specific characters), it has led to the most absurd results and has been followed by no one. Briefly, then, it is as follows:[1]—

Class *Porifera.*

Order 1. Calcarea.
Order 2. Silicea.
Order 3. Keratosa.

The "Silicea" and "Keratosa" are further divided into suborders (but these have no names) and then straightway into genera. The Monaxonida are chiefly to be found amongst the Silicea, being dispersed through five suborders; but two genera, *Chalina* and *Ophlitaspongia*, are relegated to the Keratosa.

Gray took the field armed with a much more elaborate scheme, which cannot be said to possess even the advantage of simplicity; it was as follows:[2]—

Class *Poriphora.*

Subclass 1. P. Silicea.

Section A. Thalassospongia.

Subsection 1. Leiospongia.

Order 1. Keratospongia.

Families—

1. Spongiadæ.	4. Dysideidæ.	7. Halichondriadæ.
2. Ceratelladæ.	5. Chalinidæ.	8. Polymastiadæ.
3. Hirciniadæ.	6. Phakelliadæ.	9. Ophistospongiadæ.

Order 2. Suberispongia.

Families—

1. Suberitidæ.	2. Raphiophoridæ.	3. Clioniadæ.

[1] *Vide* Mon. Brit. Spong., vol. ii. p. xx.

[2] The arrangement of the subclass Silicea here quoted, is to be found in Gray's paper—Notes on the Classification of Sponges, in *Ann. and Mag. Nat. Hist.*, ser. 4, vol. ix. p. 446, 1872. The Calcarea are not dealt with in this, Gray's second, scheme, but his arrangement of them will be found in his first scheme in *Proc. Zool. Soc. Lond.*, 1867, p. 553.

Order 3. Arenospongia.

Family 1. Xenospongiadæ.

Subsection 2. Acanthospongia.

Order 4. Hamispongia.

Families—

1. Esperiadæ.
2. Desmacidonidæ.
3. Hamacanthidæ.
4. Gelliadæ.

Order 5. Coralliospongia.

Families—

1. Pteronemadæ.
2. Lanuginellidæ.
3. Euplectelladæ.
4. Hyalothaumadæ.
5. Macandrewiadæ.
6. Farreadæ.
7. Dactylocalycidæ.
8. Aphrocallistidæ.
9. Corbitellidæ.
10. Askonematidæ.
11. Carteriadæ.
12. Axidæ.

Order 6. Sphærospongia.

Families—

1. Geodiadæ.
2. Placospongiadæ.
3. Tethyadæ.
4. Donatiadæ.
5. Theneadæ.
6. Lophurellidæ.
7. Casuladæ.
8. Chondrilladæ.
9. Ancorinidæ.

Section B. Potamospongia.

Family 1. Spongilladæ.

Subclass 2. P. Calcarea.

Families—

1. Grantiadæ.
2. Alcyoncellidæ.
3. Aphrocerasidæ.

Yet in spite of its cumbersome and largely artificial character, good features in this classification are not wanting; the best, perhaps, being that the Keratosa are here already included amongst the Silicea, a step which has been fully justified by recent research. To Gray also is due the credit of having appreciated the value of spicular forms as a means of distinguishing genera. Of Gray's families the following belong to the Monaxonida :—

Chalinidæ.
Phakelliadæ.
Halichondriadæ.
Polymastiadæ.
Ophistospongiadæ.
Suberitidæ.
Raphiophoridæ.
Clioniadæ.
Xenospongiadæ.
Esperiadæ.
Desmacidonidæ.
Hamacanthidæ.
Gelliadæ.
Spongilladæ.
? Axidæ.

Schmidt, in his work on the Atlantic Sponges,[1] makes the following main divisions, which represent his latest independent classification :—

1. *Hexactinellidæ.*	5. *Chalineæ.*	9. *Chalinopsidinæ.*
2. *Lithistidæ.*	6. *Renierinæ.*	10. *Ancorinidæ.*
3. *Halisarcinæ* and *Gummineæ.*	7. *Suberitidinæ.*	11. *Geodinidæ.*
4. *Ceraospongiæ.*	8. *Desmacidinæ.*	12. *Calcispongiæ.*

Here Groups 5, 6, 7, 8 and 9 correspond to Zittel's Monactinellidæ (Monaxonida), and, at a later date (1880), as has already been pointed out by Vosmaer, Professor Schmidt adopts Zittel's modification, grouping together Nos. 5 to 9 as Monactinellidæ, and 10 and 11 as Tetractinellidæ.[2]

We next come to Mr. Carter's classification of the Sponges, which is as follows :[3]—

Class SPONGIDA.

Order 1. *Carnosa.*
FAMILIES—1. Halisarcida. 2. Gumminida.

Order 2. *Ceratina.*
FAMILIES—1. Luffarida. 2. Aplysinida. 3. Pseudoceratida.

Order 3. *Psammonemata.*
FAMILIES—1. Bibulida. 2. Hircinida. 3. Pseudohircinida.

Order 4. *Raphidonemata.*
FAMILIES—1. Chalinida. 2. Cavochalinida. 3. Acervochalinida. 4. Pseudochalinida.

Order 5. *Echinonemata.*
FAMILIES—1. Ectyonida. 2. Axinellida.

Order 6. *Holoraphidota.*
FAMILIES—1. Renierida. 2. Suberitida. 3. Pachytragida. 4. Pachastrellida. 5. Potamospongida.

Order 7. *Hexactinellida.*
FAMILIES—1. Vitreohexactinellida. 2. Sarcohexactinellida. 3. Sarcovitreohexactinellida.

In this scheme the following families are Monaxonida :—

Chalinida.	*Pseudochalinida.*	*Renierida.*
Cavochalinida.	*Ectyonida.*	*Suberitida.*
Acervochalinida.	*Axinellida.*	*Potamospongida.*

All these schemes of classification have been fully discussed by Dr. Vosmaer in his useful and comprehensive work on the Porifera, in Bronn's Klassen u. Ordnung. des Thierreichs, a work which has been of great service to us in compiling these pages; hence no discussion is needed here, and we give them, as shortly as possible, only

[1] Grundzüge einer Spongien-Fauna des Atlantischen Gebietes, 1870.
[2] Spong. Meerb. von Mex., pt. 2.
[3] *Ann. and Mag. Nat. Hist.*, ser. 4, vol. xvi. p. 126.

for the sake of showing what has been the fate of the Monaxonida at the hands of the more recent authorities on the subject. We must now investigate the position assigned to the group by Dr. Vosmaer himself. His system, based as it is upon all that was good of the various old schemes, is naturally a great improvement upon any of its predecessors. In brief outline it is as follows :—

PORIFERA.

Class I. Porifera non-calcarea.

Order 1. Hyalospongiæ (= Hexactinellida).

Order 2. Spiculispongiæ.

Suborder I. Lithistina.
,, II. Tetractina.
,, III. Oligosilicina.
,, IV. Pseudotetraxonia.
,, V. Clavulina.

Order 3. Cornacuspongiæ.

Suborder I. Halichondrina.
,, II. Ceratina.

Class II. Porifera calcarea.

Order 1. Homocœla.
Order 2. Heterocœla.

Here the two suborders Clavulina and Halichondrina correspond to the Monaxonida, and in the present work these two suborders are maintained as the two primary divisions of the group, though it has been found necessary, after a careful study of the large amount of material at our disposal, to modify somewhat the arrangement of the smaller subdivisions. Dr. Vosmaer, we may here mention, subdivides the Clavulina and Halichondrina as follows :—

Suborder *Clavulina*.
Families—1. Polymastidæ. 2. Suberitidæ. (3. Clioniadæ.)

Suborder *Halichondrina*.
Families—1. Halichondridæ. 2. Spongillidæ. 3. Desmacidonidæ. 4. Ectyonidæ.

Quite recently[1] Professor Sollas has published the outlines of a slightly different modification of already existing schemes, in which the meaning of the name Monaxonida

[1] *Sci. Proc. Roy. Dub. Soc.*, vol. v. part ii. p. 112.

is enlarged to include the Keratosa, while the name *Monaxona* is made more or less exactly synonymous with the older Monaxonida; thus :—

PORIFERA (Phylum).

Class I. PLETHOSPONGIÆ.

Subclass 1. Hexactinellida,		Order 1. Lyssakina (Zittel). „ 2. Dictyonina (Zittel).
Subclass 2. Demospongiæ,	Tribe *a.* Monaxonida,	Order 1. Monaxona. „ 2. Ceratosa (Grant).
	Tribe *b.* Tetractinellida,	Order 1. Choristida (Sollas). „ 2. Lithistida (O. Scdt.).
Subclass 3. Myxospongiæ,		Order 1. Halisarcosa (O. Scdt.). „ 2. Chondrosiosa.

Class II. CALCISPONGIA.

Finally, Dr. R. von Lendenfeld has, in a paper recently read before the Zoological Society of London,[1] given an elaborate scheme of classification of Sponges agreeing more or less closely in its main features with that of Dr. Vosmaer, and adapted, as regards the smaller subdivisions, from the most recently published works on the subject. To this paper we would refer the reader who seeks for further information on this much-vexed question. As the portion of the scheme bearing upon the Monaxonida is derived chiefly from our own Preliminary Report we need not here discuss it in detail.

We must, however, point out one very serious error in Dr. von Lendenfeld's paper, which appears to be a misprint. We refer to the use of the name "Monaxonida" on p. 583, instead of "Monaxonia," as opposed to the "Tetraxonia" on p. 580. We point this out as such a mistake is likely to lead to great confusion, for the term Monaxonida as used by Dr. von Lendenfeld in this place has a significance very different from that of the same term as used by ourselves.

[1] *Proc. Zool. Soc. Lond.*, December 21, 1886.

CHAPTER II.—ANATOMY AND HISTOLOGY, AND EMBRYOLOGICAL NOTES.

A. Anatomy and Histology.

We propose in this chapter to treat of the anatomy and histology of the Monaxonida under three principal headings—(I.) the skeleton, (II.) the soft tissues, and (III.) the canal system. This will be found to be on the whole a very convenient division, although not an absolute one, for we shall have to forestall our account of the soft tissues in so far as these are directly concerned with the formation of the skeleton. We hope in this manner to pave the way for a somewhat detailed discussion of the classification which we propose to give in the next chapter.

I. The Skeleton.

(*a*) The Spicules.

If any apology be needed for dealing in some little detail with a subject which has already received perhaps more than its share of attention at the hands of previous authors, it is to be found in the present state of confusion with regard to the true shapes of some of the minuter and more complex forms of spicules, and with regard to the terminology employed to describe them. Perhaps we may be allowed to say a few words here in self justification.

The leading, and in fact the only really comprehensive work on the subject published in English is Bowerbank's Monograph of British Spongiadæ, and this work leaves the matter in such an unsatisfactory condition that it is absolutely necessary to go over the ground again in order to facilitate a proper understanding of the subsequent pages. Let us see how far these remarks are supported by a brief examination of Dr. Bowerbank's system.

In the first place we are told[1] that "the spicula may be conveniently classed under the following heads :—1. The essential skeleton spicula. 2. The auxiliary spicula." The auxiliary spicula are subdivided into—"Connecting spicula. Prehensile spicula. Defensive spicula. Tension spicula. Retentive spicula. Spicula of the sarcode. Spicula of the ovaries and gemmules." This appears to us an extremely artificial arrangement, moreover it would be very inconvenient in practice, for how can anyone decide whether a given "skeleton spicule" is "essential" or "auxiliary?" Or how are we to know whether a spicule is a "Tension spiculum" or a "Retentive spiculum?" We are told that these two classes of spicules are both appropriated to the "membranous tissues of sponges," and that "the office of the first of these is simply to strengthen and support those

[1] Mon. Brit. Spong., vol. i. p. 13.

delicate tissues when necessary, and to communicate to them a certain amount of tension when it is required," while "the office of the second class is that of assisting in the retention and protection of the sarcode on the interstitial and other membranous structures." Leaving aside the question as to what an interstitial membranous structure may be, we may point out in passing that these statements are based upon unproved theory.

As to the forms assumed by many of the spicules, Bowerbank's work is also unsatisfactory. No one could well go wrong with regard to the larger "essential skeleton" spicules, and we consequently find these correctly figured in the plates, but the terminology employed to describe them is most unfortunate; who, for example, could bring himself to make use of the term "Fusiformi-attenuato-cylindrical,"[1] or "Exflected elongo-equiangulated triradiate,"[2] in describing the spicules of a sponge?

To discover the true form of many of the more minute spicules ("auxiliary" spicules) is, it must be confessed, a difficult task, still it is hard to see how such a careful observer as Dr. Bowerbank can have been so far misled as he was in this respect. The imperfections of his descriptions and figures show themselves in the very important group of so-called "anchorate" spicules (=*chelæ*, nobis). Quite correctly he distinguishes between two main divisions of these, the equal ended and the unequal ended, but as to the true shape of either of these he seems to have had very little idea. He subdivides both categories into "bidentate," "tridentate," and "palmate." The tridentate and palmate forms, as he himself indicates, run into one another, while a mere tyro, by the examination of Dr. Bowerbank's figures and comparison of these with actual specimens, may satisfy himself in a very short time that the "bidentate" form is neither more nor less than a side view of either of the other two. Yet again and again do we find sponges described by Dr. Bowerbank as possessing two kinds of "anchorates," the two views being carefully figured as distinct spicules.[3] On pl. xlvi., vol. iii. of the Monograph of British Sponges, for example, fig. 12 is obviously the side view, and fig. 13 the front (or back?) view of the same spicule, but we find the following descriptions:—"Fig. 12.—A bidentate, inequi-anchorate, retentive spiculum, from the dermal membrane. × 530 linear. Fig. 13.—A dentato-palmate, inequi-anchorate, retentive spiculum, from the interstitial membranes. × 530 linear. This form of spiculum was not observed in the specimen of the sponge first examined. In the specimen figured they are about equal in number to the bidentate spicula." Moreover, the figures of the spicules are rarely complete, the "anterior palm," owing to its great transparency difficult to make out, being almost invariably omitted.

It is in our opinion of the greatest importance that these errors should be corrected,

[1] *Op. cit.*, vol. i. p. 231. [2] *Op. cit.*, vol. i. p. 233.

[3] The shape of the "bidentate equianchorate" spicule will be found elaborately, though somewhat unintelligibly, described on p. 46, vol. i., Mon. Brit. Spong.

and we point them out here because no one else seems to have taken the trouble to do so, and lest the student should be led to waste valuable time in endeavouring to reconcile the observed facts with Dr. Bowerbank's descriptions and figures.

It might be urged that Mr. Carter has already given good descriptions and figures of the leading forms of spicules, including even the most complex; this is true, but unfortunately these occur scattered through a number of separate papers which are not likely ever to come into the hands of any but specialists. Vosmaer has also given some general account of the spicules, but his figures of the more complex and minute forms are far from perfect, being for the most part copied from other authors.

Perhaps we need say no more in excuse of giving here a general account of the minute anatomy of the spicules, and, more especially, of discarding the old and cumbersome nomenclature, and endeavouring to bring into use a more scientific and rational terminology. The terminology here adopted is the result, in so far as that result affects the Monaxonida, of the mutual agreement of several spongologists, who consulted together with a view to formulating a set of terms which might have some chance of being generally accepted, as an experience of over twenty years has shown that this cannot be hoped of the Bowerbankian nomenclature, and there exists no other system of scientific terms to fall back upon. We give in the form of an appendix a list of the terms here employed, with the more important synonyms of other authors.

Concerning the chemical composition and the development of the spicules very little is as yet known. It is, however, a generally recognised fact that each (at any rate of the larger forms, and probably, judging from analogy, of the smaller forms also) consists of a central, axial, organic thread (the "axial thread," commonly, though incorrectly, referred to as the "central canal"), surrounded by concentric layers of a peculiar siliceous substance, vaguely spoken of as "organic silica." That the spicules are the products of the activity of special cells (silicoblasts),[1] within which they originate, is now also an admitted fact; but it is also pretty certain that the larger forms at any rate become free from the parent cell (silicoblast) before attaining their full size. Whether it be within or without the cell, the spicule grows by apposition. The axial thread appears to be the portion first developed, and upon the form assumed by this in the course of its growth, depends the form of the fully developed spicule. Not infrequently, in the case of the minuter forms of spicules, several originate in one and the same silicoblast, and they then remain together in bundles for a longer or shorter period; to such bundles the general term *dragmata*[2] is here applied.

This brief account of the nature and growth of siliceous spicules is necessary for the

[1] *Vide* Pl. XXI. fig. 13., and *cf.* Vosmaer, Bronn's Klassen u. Ordnungen d. Thierreichs, Porifera, p. 436, where the name "Silicoblast" is first introduced.

[2] Greek, δράγμα, a sheaf.

proper understanding of the various forms which they assume. For further details the reader is referred to the works cited below.[1]

The spicules of the Monaxonida may be very conveniently divided into two classes. Those of the first class constitute (with or without the aid of horn-like cementing substance, or spongin) the true skeleton of the sponge. They commonly occur associated together in tracts or in definite fibres, and are usually, when full grown, much larger than those of the second class; consequently the name *megasclera* is applied to them.

The spicules of the second class occur, as a rule, irregularly scattered through the soft tissues without taking part in the formation of the true, continuous skeleton. Their function is in most cases very doubtful. Owing to their minute size they are termed *microsclera*.

Megasclera.

In the Monaxonida the megasclera are (with few exceptions), as the name of the group implies, uniaxial; that is to say, the imaginary axis of the spicule, which finds its nearest visible representative in the axial thread, remains unbranched, although it may be more or less curved, or even bent at rather a sharp angle. Such a spicule may either grow in two directions from its point of origin, or in one direction only. In the former case two equivalent and usually similar rays arise more or less diametrically opposite to one another, and the spicule is consequently said to be *diactinal*, the point of origin remaining at or near the centre of the spicule. In the latter case one ray only is formed, and the point of origin, commonly represented by a bulbous enlargement of the axial thread, remains at the end of the spicule, which may or may not be swollen; in this case the spicule is said to be *monactinal*. Although it is impossible in many cases to demonstrate with certainty the manner in which the growth of a spicule takes place, yet the division into monactinal and diactinal is a very convenient one for all practical purposes. The diactinal appears to be the simpler type, from which the monactinal is derived by abortion of one of the rays.

A. *Diactinal megasclera.*

Here we may distinguish four fundamental types, which, however, run into one another by imperceptible gradations, but for which it is convenient to have distinct names for purposes of description.

1. *Oxea* (woodcut, Fig. I., 1); these are straight or curved spicules, more or less fusiform, and gradually pointed at each end.

[1] *Cf.* Bowerbank, Mon. Brit. Spong., vol. i. p. 6, &c.; Carter, *Ann. and Mag. Nat. Hist.*, ser. 2, vol. xx, p. 23, pl. i.; and ser. 4, vol. xiv. p. 100, pl. x.; Vosmaer, Bronn's Klassen u. Ordnungen d. Thierreichs, Porifera, pp. 187, 436, &c.

2. *Tornota* (woodcut, Fig. I., 2); the tornote form differs from the oxeote in having the ends abruptly and suddenly pointed.

Fig. I.—Diactinal megasclera.

3. *Strongyla* (woodcut, Fig. I., 3); here the spicule is not pointed at all, but the ends are evenly rounded off.

4. *Tylota* (woodcut, Fig. I., 4); in these forms the spicule has a swelling at each end, so that it is divisible into a central, elongated, cylindrical shaft and two terminal heads.

B. *Monactinal megasclera.*

Of these we need only distinguish two fundamental types:—

1. *Styli* (woodcut, Fig. II., 1); pointed at one end and evenly rounded off at the other without any swelling.

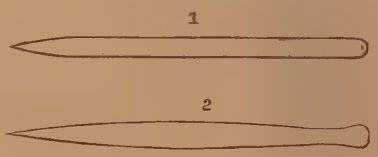


Fig. II.—Monactinal megasclera.

2. *Tylostyli* (woodcut, Fig. II., 2); in which a head is developed at one end of the spicule.

In the case of monactinal spicules it is convenient to distinguish between a "base," which is the blunt end of the spicule, and an "apex," which is the pointed end.

C. *Branched megasclera.*

We have now to speak of certain rarely occurring branched forms, which constitute an exception to the general rule that the spicules of the Monaxonida are uniaxial. The

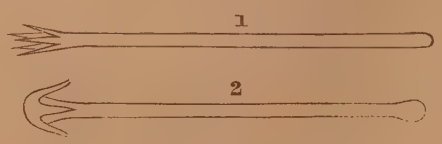


Fig. III.—Branched forms of megasclera.

angle which the branches make with the shaft may be either greater than 90°, as in woodcut, Fig. III., 1, or less than 90°, as in woodcut, Fig. III., 2.

1. *Cladostrongyla* (woodcut, Fig. III., 1); when the spicule is branched at one end and

simply rounded off at the other it is said to be *cladostrongylote*, and the spicules are *cladostrongyla*. Such spicules occur in *Thrinacophora funiformis*, nobis (*vide* Pl. XXIII. figs. 1*e*, 1*f*).

2. *Cladotylota* (woodcut, Fig. III., 2); when it is branched at one end and swollen into a knob at the other, it is said to be *cladotylote*, and the spicules are *cladotylota*. Such forms occur in the genus *Acarnus*.

Any of the above forms of megasclera may become spinose, as frequently happens in the case of styli (*e.g.*, in the genus *Myxilla*), but this in no way affects their fundamental forms or the names applied to them.

Swellings, also, may be developed elsewhere than at the ends of the spicule; hence, when there is a swelling in the centre of the spicule it is said to be *centrotylote* (Pl. IX. fig. 2, *b*, *c*), and when there are several swellings on a spicule (no matter where they are situate) it is said to be *polytylote* (Pl. XIX. figs. 9, 9′).

Microsclera.

The microsclera of the Monaxonida exhibit considerable variety in form, and it is no easy matter to arrange them satisfactorily in natural groups. The simplest plan, and that which we shall adopt here, is to consider them under three heads—(A) simple linear forms, (B) hooked forms, and (C) stellate forms. This may be an artificial arrangement, but it is a convenient one in practice, and as yet we hardly know enough about the question to allow of a more philosophical classification.

A. *Simple Linear Forms.*

1. Minute *oxea* (woodcut, Fig. IV., 3), which are generally if not always spined, as in *Dendropsis bidentifera*, nobis (Pl. XL. fig. 7*c*), *Spongilla lacustris*, &c.

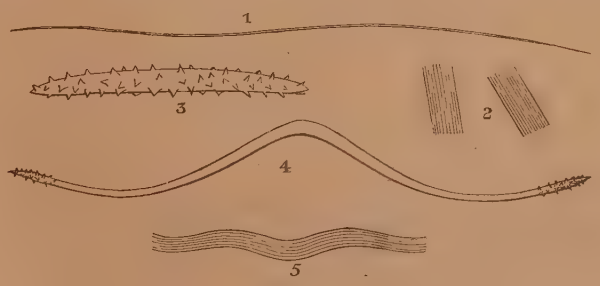


Fig. IV.—Linear forms of microsclera.

2. *Rhaphides* (woodcut, Fig. IV., 1); long, hair-like spicules, not in sheaves. These occur in great abundance in the genus *Tedania*.

3. *Trichodragmata* (woodcut, Fig. IV., 2); hair-like spicules arranged in more or less compact bundles. Such forms are very common in the genus *Esperella*.

4. *Toxa* (woodcut, Fig. IV., 4); bow-shaped spicules, tapering towards either extremity and with the ends often spinose. These occur in many sponges. A slight modification of the type is found in the "forcipiform" spicule of *Halichondria forcipis*.[1] In one sponge, *Amphilectus pilosus*, nobis, we have found the toxa, which in the young condition are very distinct and strongly curved, passing by gradual transitional stages into simple, much elongated, slender oxea of such a size, that, did they occur apart from the small toxa, they would certainly be classed amongst the megasclera (*vide* Pl. XIX. figs. 5*a*–5*a*''''). This fact well illustrates the difficulty in classifying spicules according to size and form.

5. *Toxodragmata* (woodcut, Fig. IV., 5); more or less compact bundles of toxa, which have all developed in one and the same cell.

B. *Hooked Forms.*

1. *Sigmata* (woodcut, Fig. V., 1, 2); each consisting of a slender, cylindrical shaft, which is curved over so as to form a more or less sharp hook at each end. The two terminal hooks may curve both in the same direction, when the spicule is said to be simple (woodcut, Fig. V., 2), or they may curve in different directions, when it is said to be contort (woodcut, Fig. V., 1). There is, however, no real distinction between the two, and, as a matter of fact, the spicules are nearly always contort to some extent.

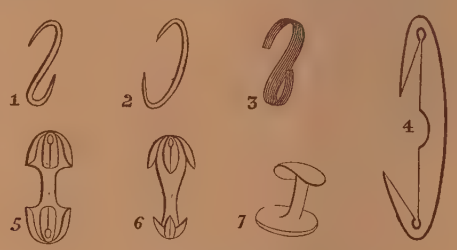


Fig. V.—Hooked forms of microsclera.

Sigmata are perhaps the commonest of Monaxonid microsclera, being very characteristic of the Desmacidonidæ.

2. *Sigmadragmata* (woodcut, Fig. V., 3); more or less compact bundles of sigmata, which have all developed in one and the same cell.

3. *Diancistra* (woodcut, Fig. V., 4); hooked forms of very peculiar shape; characteristic of the subfamily Hamacanthinæ. The spicule resembles a large stout sigma, but the inner margin of both shaft and hook thins out into a fine knife-edge, notched as

[1] *Vide* H. J. Carter, *Ann. and Mag. Nat. Hist.*, ser. 4, vol. xiv. p. 247, pl. xiv. fig. 32; *cf.* also the same spicule in *Forcepia colonensis, tom. cit.*, p. 248, pl. xv. fig. 47.

shown in the figure. Usually, at any rate, the spicule is more or less contort, the two hooks lying in two different planes.

4. *Chelæ* (woodcuts, Fig. V., 5, 6, and Fig. VI.); these are the most complex of all the microsclera, and present us with a considerable range of variation in detail. The fundamental shape will be best understood from the accompanying figures, so we shall make the description short.

It will be seen that each spicule consists of a more or less curved "shaft" (*s*), bearing at each end a variable number of sharply recurved processes (*at*, *at'*, *lt*, *lt'*) which may be conveniently spoken of as the "teeth," or, when they are broad and much expanded, the "palms." Each tooth or palm is connected with the shaft by a buttress-like projection of the latter, called by Mr. Carter[1] the "falx," and generally itself consists of a thin, flattened, oval lamella, so transparent as to be very difficult to make out. The terminal portion of the falx, upon which the tooth or palm directly rests, has been called by Mr. Carter the "tubercle" (*t*, *t'*); it is generally very conspicuous through the transparent lamella. Very commonly there is a single central or anterior tooth (*at*, *at'*), and two lateral teeth (*lt*, *lt'*) placed one on each side of it. When the teeth are comparatively narrow and the two lateral teeth are completely cut away from the shaft, as in Fig. VI., 1, 1*a*, the spicule is said to be "tridentate;" when, however, they are broad (forming palms) and the lateral palms remain adherent to the shaft for their entire length, the central palm alone being completely separated, as in Fig. VI., 2, 2*a*, the spicule is said to be "palmate." Numberless gradations exist between these two types, depending upon the extent to which the incisions between the lateral teeth and the shaft are carried, and upon the breadth of the teeth or palms. The distinction between the two types is, as has already been pointed out, a purely artificial one, but for the sake of convenience it may be retained. In some species (*e.g.*, *Chondrocladia concrescens* (?)) there may be as many as seven teeth completely cut away from the shaft and from one another (Pl. XXI. fig. 12), while in one species (*Sideroderma navicelligerum*) there is a very remarkable little chela (Pl. IX. fig. 8) in which there is only a single (the median) tooth at each end. The shaft itself is frequently expanded laterally into wing-like processes, or fimbriæ (woodcut, Fig. VI., *f*), which may extend along its whole length, but are more generally confined to one (or the two) ends.

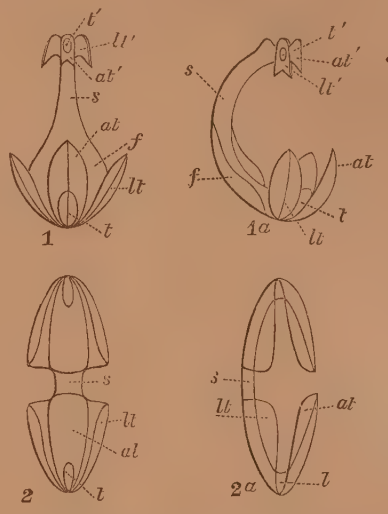


FIG. VI.—Structure of the chelæ. 1, tridentate anisochela, front view; 1*a*, same, side view; 2, palmate isochela, front view; 2*a*, same, side view; *t*, *t'*, tubercle; *at*, *at'*, anterior tooth or palm; *lt*, *lt'*, lateral tooth or palm; *s*, shaft; *f*, fimbria.

[1] *Ann. and Mag. Nat. Hist.*, ser. 4, vol. xiv. pp. 208, 209.

The whole group of chelæ, with their almost endless modifications, may be divided into two subgroups according to whether the two ends of the spicule are equal (Fig. V., 5; Fig. VI., 2, 2*a*) or unequal (Fig. V., 6; Fig. VI., 1, 1*a*); to the former class the name *isochelæ* is applied, and to the latter the name *anisochelæ*.

The most complex form of chela as yet known to us appears to be that of *Melonanchora elliptica*, figured and described by Mr. Carter.[1] Not infrequently the anisochelæ are found in "rosettes" (Pl. XVII. fig. 7), all adhering together by their small ends, which are attached to a central, granular (?) mass; no satisfactory explanation has, so far as we are aware, as yet been given of this state of things, but possibly the rosettes are comparable to the toxodragmata and sigmadragmata, which we have described above, and originate like them by the development of a number of spicules in one and the same cell. Mr. Carter also records this phenomenon in the case of the isochelæ of *Desmacidon titubans*, Schmidt.[2]

In the embryo of *Esperella mammiformis* we have succeeded in tracing the development of the chelæ in a very interesting manner. This developmental history throws an important light on the relationships of the chelæ to other forms of microsclera. In the earliest stage observed the spicule consists of a simple, slender shaft, very slightly curved in the same direction at each end, and also pointed at each end. It appears that the two pointed extremities then curve sharply inwards so as to form each an acute angle with the shaft, thereby giving to the spicule the appearance of a simple sigma with short, sharply recurved hooks and almost straight shaft. At first, as already noted by Carter,[3] the two ends are equal, but this condition does not persist for long. The teeth or palms are now developed; the central or anterior palm is formed by a delicate, oval, flattened outgrowth from the end of the hook (possibly also in part from the sides of the hook), lying in a plane at right angles to the plane of the original, simple, hooked shaft. The lateral palms are formed as lateral outgrowths from the two ends of the straight portion of the shaft. The hooks of the original spicule form the median falces and tubercles of the adult. Thus it appears that the chelate spicules develop from sigma-like forms by the formation of flattened outgrowths or buds at the two ends; hence we are justified in grouping sigmata and chelæ in the same category. In *Esperella mammiformis* the lateral outgrowths of the shaft (lateral palms) remain connected with the shaft even in the adult, the spicule (Pl. XV. figs. 18, 18*a*) being palmate; but in other species, as already noted, they often become cut away from the shaft and form distinct teeth (*e.g.*, *Cladorhiza tridentata*, woodcut, Fig. VI., 1, 1*a*; Pl. XXI. fig. 20); new lateral outgrowths may then be developed on the shaft, and these may again become cut away as teeth (*e.g.*, *Meliiderma stipitatum*, Pl. XXI. fig. 14), or

[1] *Ann. and Mag. Nat. Hist.*, ser. 4, vol. xiv. p. 212, pl. xiii. figs. 9, 10, 11, 12.

[2] *Ann. and Mag. Nat. Hist.*, ser. 5, vol. ix. p. 298, pl. xii. fig. 24, *h*. In this paper will be found a good deal of interesting information concerning the chelæ.

[3] *Ann. and Mag. Nat. Hist.*, ser. 4, vol. xiv. p. 102, pl. x. fig. 13.

remain connected with it as "fimbriæ" (*Cladorhiza tridentata, figg. citt.*), and so on.

5. *Bipocilli* (woodcut, Fig. V., 7); these are curious forms which, owing to their minute size, it is very difficult to make out satisfactorily. They occur only in a single genus, *Iophon*. Each consists of a shaft, with a terminal, cup-like expansion at each end. A modification of this type of spicule, which occurs in a new species of *Iophon*, *Iophon chelifer*, nobis (Pl. XVII. fig. 3), has the cup-like expansions divided into teeth, and thus seems to connect the bipocilli with the chelate forms.

C. *Stellate Forms.*

Microsclera of the stellate group are rare amongst Monaxonid sponges. In the Tetractinellida and in the *Tethyæ* they are, however, met with in great abundance and under a great variety of modifications. We shall describe here only those types which are certainly known to occur in the Monaxonida.

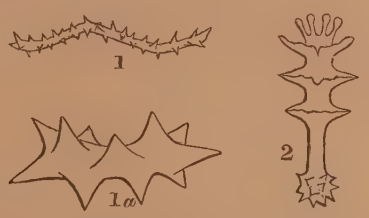


Fig. VII.—Stellate forms of microsclera.

1. *Spirulæ* (woodcut, Fig. VII., 1, 1*a*); these are more or less elongated, spiral or subspiral forms, which may be either smooth or provided with more or less numerous spines. The spinose forms are very characteristic of the genus *Spirastrella*.

2. *Discastra* (woodcut, Fig. VII., 2); spicules with a straight, elongated shaft, usually with a spinose base, and surrounded by a greater or less number of usually spinose whorls, altogether much resembling a miniature chess-man, or, in some species, a little fir tree. These spicules occur in the genus *Latrunculia*.

3. *Amphiastra*, consisting each of a cylindrical shaft bearing a single toothed whorl at each end; occurring, for example, in *Axoniderma mirabile*, nobis (Pl. XXI. fig. 9).

(*b*) The Spongin, the Spongoblasts and the Connective Tissue Sheath of the Skeleton Fibres.

Before proceeding to treat of the arrangement of the skeleton it is necessary that we should first speak of a second very important constituent thereof, viz., the spongin.

The spongin is the horn-like cementing material which, in many, though by no

means all, Monaxonid sponges unites the individual spicules into a coherent skeleton, and ultimately (in the so-called Keratosa) constitutes by itself the entire skeletal system. In chemical composition spongin has been found to resemble silk. Krukenberg has recently investigated it, and assigns to it the chemical formula $C_{30}H_{46}N_9O_{13}$.[1] Its physical characters and mode of occurrence in the sponge, however, concern us more in this place than its chemical composition. It is usually pale yellow or amber-coloured, and is arranged in concentric layers around the spicules which it unites together. Concerning its mode of formation in any sponges but true so-called Keratosa we have no actual observations. There can, however, be no doubt, from the analogy of the true Keratosa, and from its arrangement in concentric layers, that it is a secretion of glandular cells (spongoblasts). Our own histological investigations on the Challenger material throw some light upon this point. We have found, in a number of different Monaxonid sponges, sheaths of more or less fibrous connective tissue cells accompanying the fibres of the skeleton. This condition has been carefully observed by us in the following species:—*Esperiopsis challengeri*, *Axinella* (*?*) *paradoxa*, *Raspailia tenuis*, *Acanthella pulcherrima* and *Suberites perfectus*.

In *Esperiopsis challengeri*, where there is a fair amount of very pale coloured spongin, these cells are fairly abundant; they accompany the larger bands of spiculo-fibre in dense tracts, in which the individual cells lie close together side by side. They are fusiform, but apparently not usually very much elongated, measuring about 0·024 by 0·0096 mm.; occasionally, however, they seem to be drawn out into a fine, transparent thread at each end; they are highly granular and stain well with borax-carmine.

In *Raspailia tenuis* the cells in question are uncommonly well developed; and here there is also a very large amount of spongin. They occur in a thick but not densely packed sheath around the central axis, with which their longer axes are of course parallel (*vide* Pl. XLIX. figs. 1, 1*a*); they closely resemble those of *Esperiopsis challengeri* just described, and their form will be best understood from the figures. They average in size about 0·033 by 0·0096 mm. We have not succeeded in distinguishing a nucleus; the cells appear to be highly and uniformly granular throughout.

In *Acanthella pulcherrima* we have found similar granular cells scattered about fairly plentifully amongst the spicules, but not forming a definite zone around a central axis. The amount of spongin present is very small, but our thin, stained sections have demonstrated its presence beyond a doubt. Hence we cannot entirely agree with Schmidt, when he says[2] in his generic diagnosis "Parenchyma spisse impletum spiculis simplicibus longioribus, substantia firmiori non inclusis."

In *Axinella* (*?*) *paradoxa*, the fibrous tissue accompanying the bands of spicules is very highly developed (Pl. XLIX. fig. 2*a*). It is composed of very much elongated,

[1] *Cf.* Vosmaer, Bronn's Klass. u. Ordnung. d. Thierreichs, Porifera, p. 434. [2] Spong. Adriat. Meeres, p. 64.

rather slender, fusiform cells. These cells are highly granular, and often multipolar, differing really but very slightly from the ordinary mesodermal cells which occur in the ground tissue of this sponge, save for their great elongation in one particular direction (*cf.* Pl. XLIX. fig. 2). They commonly measure about 0·048 by 0·007 mm., and in some cases there appears to be a nucleus in the centre of the cell. The spongin uniting the spicules together is distinct but not very abundant.

In *Suberites perfectus* there is, as is usually the case in the Clavulina, no trace of spongin. But the skeleton fibres are accompanied and apparently held together by dense bands of very strongly fibrous connective tissue (Pl. L. figs. 2, *f.t.*, 2*a*, 2*b*). Scattered fairly abundantly through this tissue are a number of fusiform, elongated, more or less granular bodies, more numerous in some parts than in others (Pl. L. figs. 2*a*, 2*b*, *g*). The bands of fibrous connective tissue are directly continuous with the fibrous cortex.

The data before us are perhaps too scanty to justify any wide generalisation, but it is a significant fact that in *Suberites perfectus*, where there is no spongin to hold the spicules together, the fibrous element of the surrounding connective tissue is very strongly developed, and the granular element comparatively feebly developed, while in *Raspailia tenuis*, in which there is a very great deal of spongin, and hence no need for fibrous tissue to unite the spicules, exactly the reverse is the case. The other species mentioned, viz., *Esperiopsis challengeri*, *Axinella* (?) *paradoxa* and *Acanthella pulcherrima*, occupy intermediate positions between these two extremes, both with regard to the amount of spongin present and with regard to the degree of development of the granular and fibrous elements of the connective tissue respectively.

In explanation of these facts we would venture to suggest that in *Raspailia tenuis* and other species where spongin is present, surrounded by highly granular, specially modified, mesodermal elements, the latter secrete the former, and were themselves originally ordinary mesodermal cells, which have become slightly modified for the fulfilment of this special function. In other sponges (*e.g.*, *Dendrilla*), where there is a still greater development of spongin, these cells have become still more highly specialised and constitute the "spongoblasts" of the so-called Keratosa. These suggestions are in perfect harmony with the views now generally held as to the late appearance of spongin in the Porifera.

To sum up briefly, we may state that spongin is a secretion of mesodermal cells, which, originally indistinguishable from other mesodermal cells, have become under suitable conditions specially modified in form in order to fulfil their special function; and it is probable that, in at any rate some cases, these cells were derived from bands of fibrous connective tissue which accompanied the bands of spicules for the purpose of holding them together.

Coincidently with the development of the spongin the fibrous tissue in some cases

gradually disappeared; but in other cases it persisted, and in this connection it is of especial interest to note that in certain so-called Keratose sponges, *i.e.*, species in which the spongin has entirely usurped the place of the spicules, there is around the horny fibre—(1) a sheath of special spongoblasts, and (2) outside this, a sheath of fibrous connective tissue, composed of elongated, fusiform cells, and much resembling (according to the figures) that found by us in *Suberites perfectus*. This condition is described and figured by von Lendenfeld in several species, *e.g.*, *Dendrilla rosea*,[1] *Dendrilla aërophoba*,[2] and *Aulena villosa*.[3] Possibly in these cases there was originally only one thick sheath of connective tissue around the skeleton fibres, and by degrees the cells of the inner layer, next to the fibre, became specially modified as spongoblasts, while those of the outer layer retained their original form unaltered, or, very possibly, became still more fibrous in order to form a protective sheath to the layer of spongoblasts. We must imagine that the outer layer still has some important function to fulfil in order to account for its very great degree of development in certain forms (*e.g.*, *Dendrilla aërophoba*).

(*c*) The Arrangement of the Skeleton.

Although in the majority of Monaxonid sponges (the Halichondrina) there is more or less spongin present in the skeleton, yet this is, as a rule, subsidiary to the siliceous element, and serves merely as a cement to bind the spicules together in continuous fibres. Under certain conditions, however, the spongin forms by far the most important part of the skeleton, but cases in which this happens have been dealt with elsewhere.

(1) *The combination of the spicules to form fibres.*

This may take place according to three main plans, which we propose to distinguish as the *Renierine*, the *Axinellid*, and the *Ectyonine* type respectively.

1. *The Renierine type* (Pl. XLVI. figs. 2, 3, 6).—Here each individual fibre is composed of a central axis of parallel spicules, arranged either uniserially or polyserially, which may or may not be enclosed in a distinct sheath of spongin. The surface of the fibre is smooth. (Found in the Homorrhaphidæ, Heterorrhaphidæ, Esperellinæ, &c.)

2. *The Axinellid type.*—Here all the spicules of the fibre are, in a sense, "echinating." Each spicule has its base in the centre of the fibre (usually embedded in spongin), while its apex projects obliquely outwards and forwards in the direction in which the fibre is running (*i.e.*, more or less towards the surface of the sponge). There is no central core of longitudinally disposed spicules, the centre of the fibre being occupied by the bases of

[1] *Zeitschr. f. wiss. Zool.*, Bd. xxxviii. p. 286, pl. xiii. figs. 25, 26.
[2] *Loc. cit.*, p. 304, pl. xiii. fig. 28.
[3] *Proc. Linn. Soc. N.S.W.*, vol. x., pt. iii. p. 315, pl. xxx. fig. 18.

the outwardly projecting spicules. This arrangement prevails amongst the Axinellidæ, of which group it is very characteristic.

3. *The Ectyonine type* (Pl. XLVI. fig. 9; Pl. XLVII. figs. 4*a*, 5).—This agrees with the *Renierine* type, except that the surface of the fibre, instead of being smooth, is "echinated" by spicules projecting outwardly and usually more or less at right angles. The central axis of longitudinally placed spicules is generally present, but may, in a few instances, disappear, leaving only the horny fibre and the "echinating" spicules (*e.g.*, in *Clathria lendenfeldi*, Pl. XLVII. fig. 5). The echinating spicules are generally different from those in the centre of the fibre, but may, though very rarely, be the same (*e.g.*, *Echinoclathria favus*). Such fibre is characteristic of the subfamily Ectyoninæ, and is apparently confined to this group.

These three principal types of fibre all occur in the Halichondrina. In all three the amount of spongin present is extremely variable. In the Clavulina on the other hand, where, it will be remembered, there is no spongin present, we are acquainted only with the *Renierine* type of arrangement; the fibres, when distinct fibres are present, being composed of longitudinally placed spicules lying parallel with one another.

In all Monaxonid sponges there are usually a great number of megasclera scattered irregularly through the tissues, in addition to those which enter into the composition of the fibre.

(2) *The Arrangement of the Skeleton at large.*

In this case we have only two main types of arrangement to deal with. First, *Reticulate*, and second, *Radiate*.

1. The *Reticulate* arrangement, characteristic of nearly all the Halichondrina. In cases where this arrangement obtains the spicules may either be arranged (at any rate partly) in distinct fibres, or scattered separately through the soft tissues without any arrangement whatever (as in *Halichondria solida*, nobis). The fibres, when present, may belong to any of the three types above described. The essential character of a reticulate skeleton is that the fibres, or individual spicules in cases where no fibres exist, should cross and recross one another, so as to give rise to a network with closed meshes (Pl. XLVI. figs. 2, 3, 4, 6, 9). All gradations exist between a reticulation of separate and quite irregularly scattered spicules and a reticulate skeleton with perfectly definite rectangular meshes whose boundaries are formed of compact fibres (Pl. XLVI. figs. 3, 6).

When the skeleton is rectangularly arranged (as in *Reniera*, *Chalina*, *Esperella*, &c.), it is easy to distinguish between two sets of fibres—(1) *Primary fibres* (Pl. XLVI. fig. 3, *a*), running vertically towards the surface of the sponge, and (2) *Secondary fibres* (Pl. XLVI. fig. 3, *b*), crossing the primary fibres at right angles. When the primary fibres are composed of longitudinally arranged monactinal spicules these have, as a general rule, their apices all pointing in one direction, towards the surface of the sponge. At the

surface of the sponge, also, the spicules (whether monactinal or diactinal) composing the primary fibre very commonly spread out so as to form divergent brushes, upon which the dermal membrane rests (Pl. XLVII. fig. 6).

In another important, though less common type the skeleton is regularly reticulate without its being possible to distinguish between primary and secondary fibres. In this case the meshes of the reticulation are triangular, with equal sides each of exactly one spicule's length. Hence there can be no long, continuous fibres such as exist in a rectangularly meshed skeleton, the greatest continuous length of fibre possible being determined by the length of the spicules. Such a skeleton is found in *Myxilla rosacea*, var. *japonica*, nobis (*vide* Pl. XLVII. fig. 3).

2. The *Radiate* arrangement.—This is characteristic of the Suberitidæ, and, to a less

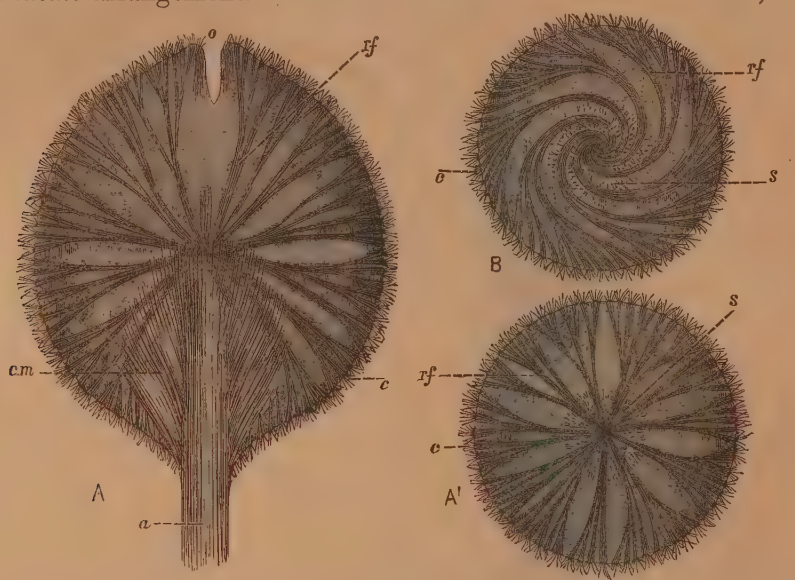


FIG. VIII.—*Stylocordyla stipitata*, var. *globosa*. Sections showing the arrangement of the skeleton. A, longitudinal section of a specimen which exhibits no spiral arrangement of the fibres, × 6. A′, transverse section of do., × 4. B, transverse section of a specimen in which the fibres are spirally disposed, × 4; *o*, osculum; *c*, cortical spicules; *a*, stem; *cm*, central mass of spicules derived from the breaking up of the stem; *s*, sections of do.; *rf*, the radiating skeletal fibres.

extent, of the Axinellidæ. The fibres or bands of spicules radiate to the surface from a common centre, and there are no crossing fibres (*vide* woodcut, Fig. VIII.). In the Axinellidæ the common centre of radiation is usually much elongated, so as to give rise to a central axis of fibre from which other fibres radiate to the surface. The same may take place in the genus *Suberites* (*e.g.*, *Suberites elongatus*, nobis, *Suberites axiatus*, nobis, &c.). Thus the radiate type of skeleton differs principally from the reticulate type with regular rectangular meshes in that there are primary but no secondary fibres present.

The skeleton of most Monaxonid sponges, whether reticulate or radiate in its arrangement, is generally divisible into two parts—(1) the *Dermal skeleton* (Pl. XLVII. fig. 3, *d.s.*), at the surface of the sponge, specially modified to support and protect the

ectosome, and (2) the *Main skeleton* (Pl. XLVII. fig. 3, *m.s.*), which forms the main mass of the skeleton, supporting the canal system, &c., in the interior of the sponge. The dermal skeleton is very frequently distinguished from the main skeleton by a different arrangement of the component parts, which is often very striking. It may be either reticulate, composed of more or less definite fibres, or of scattered spicules laid horizontally, or radiate, composed of spicules arranged vertically to the surface with their apices projecting outwards. Thus in *Plumohalichondria mammillata*, the dermal skeleton is a very compact and regular, polygonally-meshed reticulation of spiculo-fibre (Pl. XLVII. fig. 4), while the main skeleton is radiately arranged, consisting of ascending columns of plumose fibres (Pl. XLVII. fig. 4*a*, *p.c.*) running vertically to the surface; this is an excellent example of a reticulate dermal skeleton combined with a radiate main skeleton. In *Myxilla rosacea*, var. *japonica*, on the other hand, we have a radiate dermal skeleton combined with a reticulate main skeleton (*vide* Pl. XLVII. fig. 3). A radiate dermal skeleton and a radiate main skeleton, however, generally occur together. Thus in the genera *Suberites* and *Stylocordyla* (woodcut, Fig. VIII.) the dermal skeleton is composed of brushes of small, outwardly projecting spicules, often so closely packed together as to form a dense, velvet-like pile.

Very commonly, also, the individual spicules of the dermal skeleton differ from those of the main skeleton. This difference may concern merely the size, as is the case in most Suberitidæ, or it may concern the shape of the spicules. In *Tedania*, and again in *Myxilla*, we always find a diactinal dermal spicule (oxeote, tornote or tylote) combined with a monactinal main skeleton spicule (stylote), and in the Spirastrellidæ (*Spirastrella* and *Latrunculia*) there is usually a special dermal crust of quite peculiar spicules (spirulæ and discastra) which we here consider as belonging to the category of microsclera.

Fig. IX.—*Meliiderma stipitatum*. Spicules encrusting the stem. × 400.

In two genera (both new) of deep-sea Desmacidonidæ, we have discovered very extraordinary special dermal spicules in addition to the ordinary spicular complement of the group to which they belong. In the one case, *Axoniderma*, the spiculation would be that of the genus *Cladorhiza*, were it not for the existence of a dense external armature composed of a thick layer of large amphiasters; and in the other case, *Meliiderma*, we have a stipitate sponge agreeing in spiculation with the genus *Chondrocladia*, except for the presence of a layer of quite peculiar spicules (woodcut, Fig. IX.) which encrust the stem. In both cases there can be little doubt that the extra spicules have been acquired in order to guard against the attacks of enemies, a purpose for which they are admirably adapted.

Not infrequently the true dermal skeleton is replaced, more or less entirely, by foreign bodies, such as grains of sand, sponge-spicules, &c. These foreign bodies may be

collected and cemented together into definite fibres as in *Desmacidon reptans*, nobis, or they may be glued on to the surface of the sponge without any definite arrangement, as in *Polymastia agglutinans*, nobis (Pl. XLI. fig. 6; Pl. XLII. fig. 1). (The main skeleton also may be replaced to a greater or less extent by foreign bodies, but this subject will be treated of more fully in our discussion of the so-called "*Phoriospongiæ.*")

We ought not to leave this part of our subject without a few words as to the arrangement of the microsclera. These, as we have already pointed out, do not, as a rule, take part in the formation of the skeleton proper, and their function is in most cases extremely difficult to determine. Occasionally, however, it is sufficiently obvious, and in such cases it nearly always appears to be protective.[1] Thus we know of several instances in which hooked microsclera are arranged around the walls of the canals, with one end embedded in the wall and the other projecting freely into the lumen of the canal. In *Esperella murrayi*, nobis, the inhalent, and apparently some of the exhalent canals also, are plentifully armed with sigmata, each with one hook projecting into the canal (Pl. XLVIII. figs. 2, 2*c*), and in *Iophon chelifer*, nobis, we have observed the very peculiar bipocilli of that species arranged in a similar manner. In these cases there can be little doubt that the microsclera in question serve to protect the sponge from the ingress of noxious parasites, such as minute Crustacea, to whose attacks sponges seem to be peculiarly subject, by way of the canal system; just as the dermal skeleton serves to hinder these creatures from boring their way into the sponge at any part of the surface, which is a common occurrence in cases where the dermal skeleton is not sufficiently strongly developed. The arrangement of special microsclera (*e.g.*, amphiastra in *Axoniderma*, discastra in *Latrunculia*, spirulæ in *Spirastrella*) to form a dermal armour, has already been referred to and needs no further comment.

More difficult to understand are certain cases in which the microsclera are attached to the fibre of the proper skeleton. This arrangement has been described by Bowerbank [2] in the case of the diancistra of *Hamacantha johnsoni*, and the diancistra of our *Vomerula esperioides* are arranged in a similar manner, each being cemented on to the spiculo-fibre by the back of the shaft, while the sharp, cutting teeth project outwards. Moreover we have observed a similar arrangement of the large anisochelæ of *Esperella simonis*, nobis, the spicules being attached to the skeleton fibre in groups by their small ends. Probably in these cases also the spicules in question are really defensive.

It is much more common, however, for the microsclera to occur simply scattered irregularly through the mesoderm or in the limiting membranes without any pretence of arrangement, and they are often so minute and insignificant that we cannot believe that they now fulfil any function whatever.

[1] We have, however, suggested elsewhere (p. xxxi) a different function for the trichodragmata, viz., that they serve, like straw in mortar, to bind together the soft gelatinous tissues in which they lie.

[2] Mon. Brit. Spong., vol. i. p. 35.

II. The Soft Tissues.

Professor Sollas, in his Preliminary Report on the Tetractinellida of the Challenger Expedition,[1] has proposed to divide the entire body of a sponge into two parts. The first of these, or "*ectosome*," he defines as "the outer layer of the sponge, not containing flagellated chambers," and the second, or "*choanosome*," as "the 'mark' or 'parenchyma,' distinguished by the presence of flagellated chambers." This arrangement we find to be a very convenient one for practical purposes, and accordingly we shall make use of it in this Report; although applied in the first instance to Tetractinellid sponges it is equally applicable to the Monaxonida, or, indeed, to most groups of sponges. So far as the definition goes, the terms ectosome and choanosome might be used to include the skeletal elements as well as the soft tissues, but, although the two primary divisions of the skeleton into "dermal" and "main" do, roughly speaking, correspond to the two primary divisions of the soft tissues into "ectosome" and "choanosome," we have found it much the most convenient plan to treat of the skeleton all together and quite separately from the soft tissues.

(*a*) The Ectosome.

Although varying very much in details of structure the ectosome invariably consists of two kinds of elements, ectodermal and mesodermal. The ectodermal element always consists, at any rate so far as is known, of a single layer of epidermic cells—usually flat, as in *Esperella murrayi*, nobis, but in one instance (according to Vosmaer[2]) columnar. The sponge in which Dr. Vosmaer describes and figures the columnar epidermic cells is *Tentorium semisuberites*, but this must be considered as a great exception to the general rule. In our own sections of *Tentorium*, although they seem to be fairly well preserved, we have not succeeded in detecting the columnar cells. We have nothing new to add concerning the epidermis; it is very difficult to study it satisfactorily in any but specially prepared specimens.

The mesodermal constituents of the ectosome, unlike the ectodermal, vary very much in different genera both as regards quantity and character; hence it is upon these that the great diversity of the ectosome in different sponges depends. They may be very small in quantity, forming only a thin layer of connective tissue immediately beneath the epidermis, in which case the ectosome is reduced to a thin, in most parts pore-bearing membrane (Pl. XLVI. fig. 4, *d.m.*), for which the term *dermal membrane* is a very convenient one,[3] or they may be very strongly developed, forming in some instances (Suberitidæ) a thick, fibrous cortex (Pl. L. fig. 1, *ect.*).

[1] *Sci. Proc. Roy. Dub. Soc.*, vol. v., pt. vi. p. 177.

[2] Sponges of the "Willem Barents" Expedition, 1880-81, p. 19., pl. iii., fig. 23.

[3] The term "dermal membrane" is also applicable in cases where there is a thick ectosome, of which the outermost portion forms a separable membrane distinct from the remainder.

A thin ectosome, or dermal membrane, is usually associated with a reticulate dermal skeleton, as in *Pachychalina lobata* (*vide* Pl. XLVI. fig. 4); or it may simply be supported on the ends of brushes of spicules, as already described when speaking of the skeleton. It may perhaps be studied to the best advantage in the Homorrhaphidæ, but is also well illustrated in the Axinellidæ. Thus in *Phakellia ventilabrum*, var. *connexiva* (*vide* Pl. XLIX. fig. 3), it is everywhere a thin membrane, perforated on the one surface of the sponge by the pores and on the other by the oscula, and in this case there is no dermal skeleton at all.

The mesodermal constituents of a thick ectosome are, as we have already indicated, very various in nature. We have found it a very difficult matter to classify them, but have finally decided to distinguish between *stellate*, *amœboid*, *fibrous*, *vesicular* and *glandular?* These elements may be present in various combinations.

It is probable that stellate and amœboid cells are present in greater or less quantities in every ectosome, just as they are normally present in the ground tissue of the choanosome between the flagellated chambers. When they are largely developed but unaccompanied by any fibrous tissue, or with only a small proportion of it, they give rise to a thick, gelatinous ectosome, such as we have found in *Spirastrella massa*, nobis, *Axinella* (?)*paradoxa*, nobis, and in the genus *Esperella* (*Esperella gelatinosa*, Ridley, *Esperella murrayi*, nobis, and *Esperella lapidiformis*, nobis); in such cases there is, at any rate very often, a thin outer layer separable from the remainder of the ectosome as a dermal membrane.

As an example of a thick gelatinous ectosome we may take for more detailed description that of *Esperella murrayi*. In this sponge the ectosome varies much in thickness in different places, interdigitating in an irregular manner with the choanosome (Pl. XLVIII. fig. 2), a condition which appears to be rather characteristic of the genus, and strongly contrasting with the sharp distinction between ectosome and choanosome in most of those cases where the former forms a true cortex (*Suberites caminatus*, nobis, *Stylocordyla stipitata*, var. *globosa*, &c.). Immediately beneath the epidermis, which consists of the usual flattened epithelial cells, there is a thin, fibrous layer, usually about 0·01 mm. thick, resting upon a strongly developed, reticulate dermal skeleton. Below the dermal skeleton comes another thin, fibrous layer, resembling that just mentioned, and the soft tissues between the two, in which the dermal skeleton is embedded, are also more or less fibrous. Down to the bottom of the lower fibrous layer may be considered as "dermal membrane," between the ends of the primary fibres it is about 0·14 mm. thick.

The dermal membrane covering over the subdermal cavities (*vide infra*), is, however, excessively thin, and contains no dermal skeleton; it is perforated by the pores (Pl. XLVIII. fig. 2*b*), and in these areas the fibrous tissue is concentrated in special bands running from side to side between the pores (Pl. XIII. fig. 16, *b*; Pl. XLVIII. fig. 2*b*, *f*). These fibrous bands are composed of densely packed, very much elongated cells, with rather faintly discernible nuclei scattered here and there. They do not run straight from side to

side of the elongated pore-areas, but are often obliquely placed and often branched. Judging from their relation to the surrounding parts we have little hesitation in pronouncing them to be muscular in function.

Immediately below the dermal membrane thus constituted, we find, except of course where the subdermal cavities are situate, the gelatinous tissue which makes up all the rest of the ectosome. This is very loose indeed, and appears to be composed of a framework of stellate cells, each with a very small round nucleus; amongst which are scattered numerous other cells of a very different kind. These (Pl. XLVIII. fig. 2*c*, *c*.) are large, averaging about 0·015 mm. in diameter, irregular in outline and usually granular, though not very distinctly so. They stain very deeply with borax-carmine and are especially abundant around the ends of the inhalent canals. It is very difficult to decide under which of the five heads above mentioned these elements should be classed, probably with the amœboid cells. Another important constituent in the ectosome of *Esperella murrayi* is furnished by very numerous, irregularly scattered trichodragmata (Pl. XLVIII. fig. 2*c*, *t*); it seems very probable that in this and similar cases the trichodragmata, like straw in mortar, serve to bind together the loose, gelatinous tissue in which they lie.

In *Esperella lapidiformis* we have found, embedded in the gelatinous ectosome, numerous very young ova, each consisting of a rounded, granular cell, commonly about 0·02 mm. in diameter, with a small, but very distinct, central nucleus; while in the deeper parts of the sponge (choanosome) there are numerous developing embryos as well as young ova.

When, instead of being gelatinous, the ectosome is firm and tough, and contains a large proportion of fibrous tissue, we have a true cortex, such as may be studied to the best advantage in the Suberitidæ. Although the general direction of the fibres is usually more or less parallel with the surface, we commonly find also bands of fibrous tissue irregularly surrounding the subdermal cavities, as, for example, in *Stylocordyla stipitata*, var. *globosa* (Pl. L. fig. 1*a*, *f.t.*), and *Suberites perfectus* (Pl. L. fig. 2, *f.t.*). In *Suberites perfectus* also, as we have already noted, the fibrous tissue dips into the choanosome and ensheaths the skeleton-fibres.

In *Tentorium semisuberites* (Pl. L. figs. 3, 3*a*) the ectosome on the upper surface of the sponge is more than usually fibrous and is divisible into three distinct layers. There is (1) an *external* layer (Pl. L. fig. 3*a*, *a*) about 0·05 mm. thick, wherein the fibres are mostly placed parallel with the surface; (2) a much thicker, but less dense, *intermediate* layer (Pl. L. fig. 3*a*, *b*), which is honeycombed by the very numerous, elongated subdermal cavities (*s.c.*), and in which the fibres are mainly placed vertically to the surface; and (3) a dense *internal* layer (Pl. L. fig. 3*a*, *c*.), rather thicker than the external layer and, like it, with the fibres mostly arranged parallel to the surface. We know that this species has a remarkable power of contraction, which chiefly affects the upper, pore-

bearing surface. Indeed, so much does the appearance of the upper surface differ according to whether the sponge be contracted or expanded, that Sir Wyville Thomson recognised a distinct species for each of these two conditions.[1] The figures (Pl. L. figs. 3, 3*a*) represent the sponge in a partially contracted condition. Judging then from these facts, we are probably correct in assigning to the fibrous tissue of the ectosome a muscular function. In *Tentorium* the thick, fibrous ectosome is present only on the upper, pore-bearing surface (Pl. L. fig. 3, *p.a.*). Elsewhere the columnar body of the sponge is encased in a cylinder of densely packed, vertically disposed, large tylostyli. Inside of this sheath of spicules comes a thin layer of gelatinous mesoderm, containing stellate cells, and inside this again a very thin zone of fibrous tissue in which the fibres are arranged in a circular manner, running round and round the sponge; very possibly these circular fibres also are muscular in function; but, judging from their slight degree of development, we cannot suppose that they are very powerful.

The fibrous tissue of the ectosome appears to be always very much the same in histological character, composed of very slender, very much elongated cells, closely packed together, with elongated nuclei scattered here and there. The same kind of tissue is not infrequently found surrounding the larger exhalent canals (*e.g.*, *Stylocordyla stipitata*, var. *globosa*, nobis; *Latrunculia apicalis*, nobis) and in these cases also it ought possibly to be regarded as part of the ectosome.

As in the case of a gelatinous ectosome, there are usually several elements entering into the composition of the fibrous cortex. Thus, in *Stylocordyla stipitata*, var. *globosa*, there are present an enormous number of rounded or oval, nucleated cells (Pl. L. fig. 1*a*, *g.c.*) lying in and amongst the fibrous tissue; each cell measures about 0·007 mm. in diameter, is somewhat granular and stains fairly deeply with borax-carmine. They are most abundant in the outer portion of the cortex, being closely packed together and making up by far the chief portion of the ectosome in this place. What their function may be is very doubtful, but from their form and their position in the sponge we are inclined to place them in the category of "glandular (?)." We have observed similar, but more highly granular and deeply staining cells in the ectosome of *Suberites ramulosus*, var. *cylindrifera*, nobis.

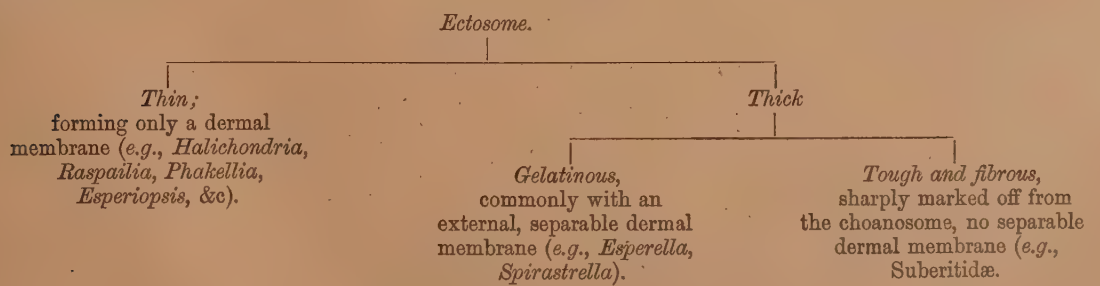
In *Latrunculia apicalis* the ectosome has a somewhat different composition. In as much as it is tough and firm and sharply marked off from the underlying choanosome (*vide* Pl. LI. fig. 1), and contains, moreover, a considerable amount of fibrous tissue, it may be considered as forming a true cortex. Here, as is also the case in the genus *Suberites*, its toughness and firm consistency are largely due to the presence in it of numerous supporting spicules, the arrangement of which is described elsewhere, and will be seen by reference to the figures. There is a thin external layer of somewhat fibrous tissue (Pl. LI. fig. 1*b*, *f.t.*), in which are embedded the bases of the closely-

[1] The Depths of the Sea, figs. 23, 24.

placed, outwardly-projecting discastra (Pl. LI. fig. 1*b*, *d*). Beneath this comes a much thicker layer of very peculiar, vesicular tissue. This is composed of closely packed, perfectly transparent, globular cells (Pl. LI. fig. 1*b*, *v.c.*) about 0·018 mm. in diameter, and each with a small, round nucleus excentrically placed. (It is interesting to observe that these cells are identical in form and size with those described and figured by Poléjaeff in the cortex of his *Cacospongia vesiculifera*.[1] We are, however, rather surprised that Poléjaeff should speak of the cells in question as "thoroughly identical with the vesicular cells of many Desmacidonidæ—undescribed indeed hitherto, but undoubtedly very well known to every spongiologist who has had to deal with the representatives of the family just mentioned." So far as our experience goes we know of no such vesicular tissue in the Desmacidonidæ.) In the outer portion of the cortex, embedded in the layer of vesicular tissue, there occur also numerous, deeply staining, nucleated, granular cells (Pl. LI. fig. 1*b*, *g.c.*) of irregular shape, of about the same size as or a little smaller than the vesicular cells. These are, for the most part, arranged in not very regular groups (Pl. LI. fig. 1, *g.c.*). It appears very possible that, like the somewhat similar cells in *Stylocordyla*, they have a glandular function. This layer of vesicular tissue with its embedded groups of glandular (?) cells gradually gives place below to a gelatinous looking tissue (in which the vesicular cells are still abundant), which, as it approaches the choanosome, becomes more or less strongly but irregularly fibrous. The lower two-thirds (roughly speaking) of the cortex are strengthened and supported by abundant spicules, as already mentioned.

In the genus *Phelloderma*, nobis, which forms a great exception to the rule that the Halichondrina are never corticate, the ectosome is about 0·25 mm. thick, and the fibrous tissue is concentrated in a zone of varying thickness in its lower part; unfortunately the histological condition of the single specimen at our disposal is not sufficiently good to allow of a more detailed description.

To sum up our observations on this head, we may briefly tabulate the chief different modifications of the ectosome in the Monaxonida as follows :—


Ectosome.
Thin;
forming only a dermal membrane (e.g., Halichondria, Raspailia, Phakellia, Esperiopsis, &c).
Thick
Gelatinous,
commonly with an external, separable dermal membrane (e.g., Esperella, Spirastrella).
Tough and fibrous,
sharply marked off from the choanosome, no separable dermal membrane (e.g., Suberitidæ.

[1] Zool. Chall. Exp., part xxxi., Report on the Keratosa, p. 59.

(*b*) The Choanosome.

According to Schulze[1] the ectoderm of the larval sponge furnishes not only the epithelium clothing the surface of the sponge, but also the epithelial lining of the canal system from the pores on the surface to the inhalent apertures of the flagellated chambers; while the endoderm furnishes the collared cells and also the epithelial lining of the canal system, from the exhalent apertures of the flagellated chambers to the margin of the osculum; the remainder of the sponge is mesodermal.

If this view be correct, all three germinal layers, viz., ectoderm, mesoderm and endoderm, take part in the formation of the choanosome.

Nevertheless the choanosome presents us with much less variety in histological structure than does the ectosome; a fact which is probably to be accounted for by the circumstance that it does not come into such direct contact with external conditions, and is hence less subject to modification. All the different histological elements (viz., stellate, amœboid, flagellated, pavement and fibrous cells) which take part in the formation of the choanosome in the Monaxonida, are, with the exception of the flagellated cells, found also in the ectosome, and we may, accordingly, dismiss this part of our subject very briefly. The extent to which the ground substance, in which the flagellated chambers are embedded, is developed varies much. In the Clavulina there is, at any rate as a general rule, very little indeed, and the flagellated chambers are packed very closely together (*vide* Pl. L. fig. 1*b*). In the Halichondrina (*e.g.*, *Esperella murrayi*, Pl. XLVIII. fig. 2*d*, and *Axinella* (*?*) *paradoxa*, Pl. XLIX. fig. 2) there is commonly more, and the chambers lie further apart from one another. It is moreover sometimes stated that there is a distinction between these two groups in the character of this fundamental tissue; that in the Clavulina it is finely granular, while in the Halichondrina it is clearer and more gelatinous. That there is some difference of this nature there can be no doubt, but it has probably also been somewhat confounded with the difference already mentioned, viz., the much smaller total amount of ground substance present in the Clavulina as compared with the Halichondrina.

We have, in short, no new facts to add concerning the histological structure of the choanosome, except with regard to the fibrous tissue accompanying the bands of spiculo-fibre, and this has already been fully dealt with in treating of the skeleton.

Special Structures.

We may conveniently describe in this place certain very remarkable and quite unique structures present in an abyssal sponge, *Cladorhiza* (*?*) *tridentata*, nobis. The shape of

[1] *Zeitschr. f. wiss. Zool.*, Bd. xxxiv. p. 438.

the sponge is very peculiar and will be best understood by reference to the annexed woodcut (Fig. X.) (see also the description on p. 95, and figs. 9, 9*a* on Pl. XX.). Embedded in the soft tissues all round the upper margin of the sponge are found, arranged in a single circle, a large number of small, yellow, globular bodies (woodcut Fig. X., *a*, and Pl. XLIX. fig. 4, *g.b.*). What these bodies may be is an extremely difficult question to decide. That they are proper to the species and not foreign objects or parasites is rendered almost certain by the fact that they occur in the same position in all three of the specimens present; and this view of the case is further strengthened by their histological structure, which we have worked out to the best of our ability in two specimens. Unfortunately the sponges are in a very bad state of preservation, but the following details of structure are quite certain.

Fig. X.—*Cladorhiza* (?) *tridentata*. Specimen attached to a stone, showing the natural position of the sponge; *a*, globular bodies of unknown function. × 2.

In radial vertical sections through the margin of the sponge (Pl. XLIX. fig. 4), we find that each globular body consists of a central, more deeply staining and granular portion (Pl. XLIX. fig. 4, *g.b.*), surrounded by and embedded in a matrix of faintly staining, perfectly hyaline ground substance (Pl. XLIX. fig. 4, *s*). The central portion is sharply marked off from the matrix in which it lies by a much more darkly staining ring, or several concentric rings of a similar substance. Within this ring we find a clear, jelly-like ground substance containing very numerous embedded cells, which give to the central part of the structure the granular appearance already mentioned. The cells themselves (Pl. XLIX. fig. 4*a*, *c*) are irregular in shape, nucleated and highly granular, averaging about 0·018 mm. in diameter. Outside the darkly staining ring we find a very similar hyaline ground substance, but less deeply staining than the inner portion and without the cells. Towards the centre of the sponge this ground substance becomes gradually vacuolated and finally merges into the network of tissue constituting the choanosome (Pl. XLIX. fig. 4, *ch.*). Above, and towards the periphery of the sponge, it appears to extend almost or quite to the dermal membrane, becoming, however, considerably vacuolated (? owing to the action of the spirit). In these parts also, but chiefly towards the periphery of the sponge, there occur, embedded in the gelatinous-looking matrix, a great number of very peculiar, cup-shaped organs (Pl. XLIX. fig. 4, *gl.*, and fig. 4*b*). Each of these is about 0·1 mm. in diameter, and consists of a large number of small (? spherical), deeply staining cells packed close together so as to form a thick-walled cup, the mouth of which is turned towards the centre of the globular body. Judging from the number to be seen in a single thin section there must be a very great many of these organs present to each of the globular bodies. Around them the hyaline matrix is frequently shrunk away from their walls (probably owing to the action of the spirit), but usually remains connected at the mouth. The gelatinous

matrix outside the deeply staining ring contains, in addition to the cup-shaped bodies, numerous other objects, such as spicules and a few large cells, which have apparently been enveloped in it accidentally, and which are arranged with none of the constancy or regularity which characterises the former.

It appears to us highly probable that the cup-shaped bodies are aggregations of glandular cells, similar to the glandular cells in the ectosome of other sponges, and that they secrete the tough, jelly-like substance, or, at any rate, that portion of the jelly-like substance outside the deeply staining ring. This is the only hypothesis on which we can explain their constancy in form and arrangement, and it seems to be greatly strengthened by two facts—(1) that they have their mouths turned towards the centre of the globular body, and (2) that the gelatinous-looking substance remains connected with the cup-shaped organ at the mouth when it has shrunk away from it (probably owing to the action of the spirit) in other places. What may be the function of the whole structure is enigmatical in the extreme; we can but describe them as we find them, and suggest, but merely suggest, that they may be phosphorescent, and serve to attract minute organisms upon which the sponge feeds. Unfortunately the specimens, which came from a depth of 1600 fathoms, are in such an unsatisfactory state of preservation that the remainder of the anatomy and histology cannot be worked out at all; the superior preservation of the structures described is probably due to their envelopment in the tough, gelatinous-looking matrix.

III. The Canal System.

(1) The Pores.

The arrangement and character of the pores are, as might be expected, most intimately correlated with the condition of the dermal skeleton and of the ectosome. The pores themselves, *i.e.*, the actual openings on the surface of the sponge, through which the water enters the sponge, present us with but little variation either in form or size. They are round or oval, and measure about from 0·05 to 0·2 mm. in diameter. We have in the systematic portion of this work given the measurements of the pores in a large number of different species, which it would be superfluous to repeat in this place; the average diameter, both in Halichondrina and in Clavulina, may be taken as about 0·1 mm.

The pores may be studied to the best advantage in those sponges (viz., the Halichondrina) in which there is a separable dermal membrane, which can be removed and examined under the microscope as a transparent object. They then appear as definitely bounded openings, often so closely placed as to reduce the dermal membrane to a mere network (Pl. XLVI. fig. 4). When, however, the sponge is corticate and there

is no separable dermal membrane, the pores must usually be sought for in sections taken at right angles to the surface. Whether the arrangement of the pores is primarily dependent upon the arrangement of the subdermal cavities or *vice versâ*, or whether both are dependent upon the arrangement of the dermal skeleton, is a very difficult question to decide. Probably the arrangement of the dermal skeleton, which is of great importance for the protection of the sponge, to a large extent determines the arrangement both of the pores and of the subdermal cavities; we shall, later on, give strong reasons for believing this to be the case. In the meantime it is sufficient to remark that all three are most intimately correlated with one another. In the first place, it is obvious that the pores, in order to fulfil their function of admitting water into the sponge, must always be placed over the subdermal cavities, from which the inhalent canals take their origin. This, together with the arrangement of the dermal skeleton, usually results in a more or less regular grouping of the pores in "pore-areas." Sometimes, however, it is impossible to detect any regular grouping of the pores whatever; they are simply scattered over the surface, here and there. We have thus two principal types of pore-arrangement to distinguish—the pores may be scattered, or they may be collected in more or less definite "pore-areas." We shall consider these two cases separately.

(*a*) *Pores scattered, not collected in definite Pore-areas.*

It is not very often that we get the pores quite irregularly scattered, for usually they are constrained to group themselves more or less regularly, either by the exigencies of the subdermal cavities or of the dermal skeleton. Still, in cases where there is no dermal skeleton present, or where this is of such a nature as not to interfere with their arrangement, we sometimes find this condition occurring; as for example, in *Petrosia hispida* (no dermal reticulation), *Reniera subglobosa* (dermal skeleton unispicular), *Vomerula esperioides* (dermal skeleton reticulate, but meshes very wide), *Esperella mammiformis* (dermal skeleton loosely reticulate), *Esperella lapidiformis* (dermal skeleton absent), *Esperella simonis* (dermal skeleton irregularly reticulate), *Desmacidon* (*Homœodictya*) *kerguelenensis* (skeleton irregular, very loose), *Myxilla rosacea*, var. *japonica* (dermal skeleton radiate), *Myxilla frondosa* (dermal skeleton loose and irregular), and most Suberitidæ (dermal skeleton radiate). But here, as in so many other cases, we can draw no hard and fast line, and in many cases it is impossible to decide whether the pores should be classed as irregularly scattered or collected in areas. Perhaps the best cases of irregularly scattered pores are to be found in the Suberitidæ, *e.g.*, *Stylocordyla stipitata*, var. *globosa*, where the dermal skeleton is radiately arranged and therefore does not interfere with the arrangement of the pores (Pl. L. fig. 1, *p.*).

(*b*) *Pores arranged in more or less definite Pore-areas.*

We may consider this part of our subject under three heads, according to whether the pores are (1) localised in areas owing to the arrangement of the dermal skeleton, (2) localised in areas owing to the arrangement of the subdermal cavities, the dermal skeleton being either absent or so feebly developed as not to interfere with their arrangement; or (3) localised in areas owing directly to the habit of the sponge.

(1) *Pores localised in areas owing to the arrangement of the dermal skeleton.*—The simplest cases of this kind (if such they can be called) are those in which the dermal skeleton is well developed and regularly reticulate, and the surface is broken up by the fibres of the reticulation into a number of polygonal areas, in which the pores are scattered. Such a condition we find in *Pachychalina lobata* (Pl. XLVI. fig. 4), but, as a glance at the figure will show, these cases might be classed almost as well under the heading of "Pores scattered."

We have, however, to consider certain very remarkable cases in which, owing to the arrangement of the dermal skeleton, the pores are collected into perfectly definite, confined areas, strongly contrasted with the remainder of the surface of the sponge. We shall describe this condition as it occurs in four distinct species belonging to four very different families, viz., *Halichondria latrunculioides*, *Esperella murrayi*, *Latrunculia apicalis*, and *Tentorium semisuberites*.

In *Halichondria latrunculioides* (Pl. I. fig. 5) the dermal skeleton is composed of a dense, continuous layer of large oxeote spicules, placed in such a manner (Pl. XLVI. fig. 5) as to leave no interstices, or very few, through which it would be possible for water to obtain entrance to the sponge. The consequence is that the pores are collected together into perfectly definite, round or oval, raised pore-areas (Pl. I. fig. 5, *p.a.*), from which the dermal skeleton is absent and in which they are so abundant as to reduce the dermal membrane to a mere sieve (Pl. I. fig. 5*a*). In the genus *Halichondria* the dermal skeleton is usually reticulate and the pores irregularly scattered or placed in the meshes of the reticulation. Our sponge agrees with the other species of the genus in all essentials, and we are obliged to consider the peculiar arrangement of the pores as a case of special adaptation, consequent upon the unusual density of the dermal skeleton over the general surface. This view of the case is supported by the fact that, where there do happen to be odd gaps in the almost continuous skeleton, we sometimes find pores in them, although they are nearly all confined to the special raised areas. This case of adaptation has an unusual interest owing to the curious resemblance which the species in question bears to another sponge coming from the same locality (Station 320), viz., *Latrunculia apicalis*, and careful investigation has shown us that the similar external form of these two species is due to the same cause in both, as will be seen later on.

In *Esperella murrayi* (Pl. XIV. fig. 1) we find a still more remarkable arrangement of the pores. Here again there is an exceedingly dense and compact dermal skeleton, and the pores are collected in definite grooves from which alone the dermal skeleton is absent. These grooves appear on the surface of the sponge like cracks (Pl. XIV. fig. 1, *p.a.*; Pl. XLVIII. fig. 2*a*, *p.a.*), and the floor of each is formed by a thin and delicate dermal membrane, overlying an elongated subdermal cavity (Pl. XLVIII. fig. 2*a*, *s.c.*), and pierced by numerous round pores (Pl. XIII. fig. 16, *c*; Pl. XLVIII. fig. 2*b*, *p.*). They are guarded on either side by dense tufts of large stylote spicules (Pl. XIII. fig. 16, *a*), and, by the action of appropriate bands of muscular fibre, running from side to side between the pores, the two sides can be brought together and the cracks closed (see also pp. xxx, 68).

In this case also we find that in other species of the genus (*e.g.*, *Esperella lapidiformis*, nobis, *Esperella mammiformis*, nobis, &c.), where the dermal skeleton is arranged in such a manner as not to interfere with the distribution of the pores, these latter occur all over the surface of the sponge; and so we must regard the arrangement of the pores in *Esperella murrayi* as due to the exceptional arrangement of the dermal skeleton. And here again this view is strengthened by the fact that, where there is room for them, there are a few odd pores scattered over the general surface of the sponge.[1]

We have now to consider a similar condition of things occurring in a corticate sponge, viz., *Latrunculia*. We have only succeeded in satisfactorily working out the relations of the pores in one species of the genus, viz., *Latrunculia apicalis*, but we have strong reasons for believing that the same arrangement obtains in at least several species of the genus, if not in all (*cf.* p. 237, &c.). It will be seen from the figure (Pl. XLIV. fig. 4) that the upper surface of the sponge is covered with mammiform projections. Those nearer the top are larger than the remainder and not nearly so abundant; each one is conical and has a distinct oscular opening at the summit, to which a wide exhalent canal leads up (Pl. LI. fig. 1). The smaller processes, on the other hand, are cylindrical and abruptly truncated at the top, which is commonly slightly concave and without any opening visible to the naked eye; in longitudinal section (Pl. LI. fig. 1) we see, however, that numerous slit-like pores (*p*) lead from the surface vertically

[1] Vosmaer has described in *Esperella lingua*, Bk. sp., a localisation of the pores in grooves very similar indeed to that which occurs in *Esperella murrayi*, only in the former case the localisation appears to be due to the fact that the general surface of the sponge is covered with sand; he says, "The most remarkable thing in *Esperella lingua* is perhaps the incurrent canal-system. The sponge, covered with sand, shows on its surface numerous fissures that are not covered with sand. In examining the sponge with a lens it becomes clear that in these places the pores are situated (fig. 22, pl. iv.)," Sponges of the "Willem Barents" Expedition, 1880–81, p. 30. Bowerbank in his description mentions no such pore-cracks, and we were inclined to think that Vosmaer's species could not be the same; but on examining Bowerbank's dried type (Mon. Brit. Spong., vol. iii., pl. lxxvii. fig. 1) we found the pore-cracks in one or two places in a most perfect condition, and were enabled to make a microscopic preparation which showed them to be identical with those of *Esperella murrayi*, even down to the presence of the transverse bands of muscular (?) tissue. Unfortunately, we were not aware of these important facts until after our description of *Esperella murrayi* was printed, so that we have made no comparisons in that place. The two species are, however, perfectly distinct, as shown by the external form, the arrangement of the skeleton and certain details of spiculation.

downwards, between radiating brushes of spicules, into one large inhalent canal (*i.c.*), from which smaller canals or lacunæ originate. Here again we find an intimate connection between the arrangement of the pores and the nature of the dermal skeleton, for the entire surface of the sponge, except on the tops of the raised pore-areas, is covered with a dense, continuous armour of outwardly projecting discastra (Pl. LI. figs. 1, *d*; 1*b*, *d*), between which there is no room for the pores. We have already seen how a similar arrangement of the pores, consequent upon the denseness of the dermal skeleton (which is, however, very differently arranged in the two cases, as will be seen by comparison of Pl. XLVI. fig. 5, with Pl. LI. fig. 1*b*), in a totally different sponge, viz., *Halichondria latrunculioides*, has given rise to a similar external form.

We ought perhaps also to consider under this head one more case, viz., that of *Tentorium semisuberites*, in which there is, however, only a single, large pore-area. The arrangement of the dermal skeleton and ectosome in this sponge has been already referred to (p. xxxi), the columnar body (Pl. L. fig. 3) is encased in a quite impenetrable sheath of spicules, except at the top (Pl. L. fig. 3, *p.a*), where the dermal skeleton is differently (radiately) arranged. In the centre of the cushion-like top arises usually a single oscular tube (Pl. L. fig. 3, *o*), and all around this are numerous pores, seen best in longitudinal section (Pl. L. fig. 3*a*), leading into the elongated subdermal cavities between vertical brushes of spicules, much as in other Suberitidæ. There are no pores except on the summit of the sponge.

(2) *Pores localised in areas in accordance with the arrangement of the subdermal cavities; the dermal skeleton being either absent, or so feebly developed as not to interfere with their arrangement.*—This condition is found most frequently in non-corticate sponges, and here, as before, it is impossible to say exactly where the scattered condition ceases and localisation begins. We shall content ourselves with taking a few examples in which the localisation is more or less distinctly marked.

In the genus *Myxilla* it is exceedingly common to find the surface of the sponge marked out into more or less regular, oval or rounded pore-areas, marking the position of the underlying subdermal cavities, and this without any relation to the dermal skeleton, which is commonly very vaguely and poorly developed; as examples we may cite *Myxilla cribrigera*, nobis, *Myxilla mariana*, var. *massa*, nobis, *Myxilla nobilis*, nobis, and *Myxilla compressa*, nobis. Fig. 2*a* on Pl. XXX. shows this condition as seen in *Myxilla nobilis*. For further details the reader is referred to the descriptions of the several species mentioned.

We also find this condition occurring in the genus *Phakellia*, *e.g.*, *Phakellia flabellata*, nobis, where the pores occur in small groups over the ends of narrow inhalent canals; and in *Phakellia ventilabrum*, var. *connexiva*, we have much the same thing (*vide* Pl. XLIX. fig. 3). In neither of these cases is the skeleton arranged so as in any way to determine the arrangement of the pores (*cf.* p. 171, and Pl. XLIX. fig. 3).

In short, all that is necessary in order to bring about such a localisation of the pores is that the subdermal cavities should be arranged at some little distance from one another and have a number of pores leading into each.

(3) *Pores localised in areas owing directly to the habit of the sponge.*—We have only one example to adduce belonging to this class, although very likely future researches will show such a condition to be not uncommon. The example in question is a deep-sea sponge, *Tedania actiniiformis*, nobis, obtained at Station 299 (off Valparaiso), at a depth of 2160 fathoms and on a bottom of blue mud. The external form of the sponge will be best understood from the figure (Pl. XI. fig. 2; *cf.* also p. 55); it is attached to a piece of rock. At a short distance below the flattened top there is a definite narrow zone (Pl. XI. fig. 2, *p.z.*, and fig. 2*a*) of pores encircling the sponge. In this zone the pores are so abundant as to reduce the dermal membrane to a mere network. Judging from the general appearance of the sponge and the nature of the bottom upon which it lives, we have little hesitation in saying that in life it was buried in the mud up to within a short distance of the top, and hence the pores, in order that clean water might gain access to them, became confined to that portion of the surface which was above the mud, namely, a narrow zone immediately below the flattened top. The genus *Tedania* is characteristically an inhabitant of shallow water, and in no other species do we find an arrangement of the pores similar to that which characterises this deep-sea form. There can be no doubt that in this case the arrangement of the pores is dependent directly upon the habit of the sponge, and not, as in most cases, upon the arrangement of the dermal skeleton or of the subdermal cavities.

FIG. XI.—*Cliona dissimilis.* Vertical section of a decalcified specimen; *o*,*o*, oscula; *pa*, pore-areas; *c*, ectosome; *ic*, inhalent canals; *ec*, exhalent canals. × 4.

Before leaving the question of the pores we must consider briefly the condition of flabellate sponges in this respect. It is an almost invariable rule, that in flabellate sponges the pores are to be found on one surface and the oscula on the other. Thus in *Phakellia ventilabrum*, var. *connexiva* (Pl. XXXV. figs. 3, 3*a*; Pl. XLIX. fig. 3), and *Phakellia flabellata*, nobis (Pl. XXXIV. figs. 2, 3, 3*a*), this arrangement is very well illustrated, and the same condition occurs in *Myxilla frondosa*, nobis (Pl. XXVI. figs. 1, 1*a*); and *Gellius flabelliformis*, nobis (Pl. XXVI. figs. 5, 5*a*). Again in that very remarkable sponge *Esperiopsis challengeri* (Pl. XVIII.) the pores occur only on the concave surfaces of the lamellæ (Pl. XVIII. fig. 4), while the oscula are all on the convex surfaces.

By far the most remarkable instance of this kind is, however, afforded by a boring

Suberite which we have described under the name *Cliona dissimilis* (p. 227; Pl. XXV. fig. 5, &c.). Here the sponge has bored its way into a flattened coral which it completely surrounds; hence it has itself acquired a flattened, lamellar form, and we find the pores collected in areas (woodcut, Fig. XI., *pa*), on one side of the sponge and the oscula (woodcut, Fig. XI., *o*) on the other.

There is no other known example, so far as we are aware, of a lamellar Suberitid sponge, and even the species in question is lamellar only because it has bored into a lamellar coral, and yet the pores and oscula are arranged just as they would be in a free living, frondose sponge such as *Phakellia*. There must be some strong reason why, as soon as a sponge, for any cause, acquires a lamellar form, the oscula become confined to one surface and the pores to the other, and to account for the occurrence of this condition in genera so widely separated as *Gellius*, *Myxilla*, *Phakellia* and *Cliona*. What this reason may be we cannot at present say.

(2) The Subdermal Cavities.

The subdermal cavities are the spaces into which the pores directly lead, and from which the inhalent canals proper take their origin. They might be regarded merely as the proximal portions of the inhalent canals, but inasmuch as they are sometimes very distinctly marked off from the remainder of the inhalent canal system, both by position and structure, it is convenient to treat of them separately and to retain for them a special name. Although the term *subdermal* is hardly a suitable one to apply to these structures in corticate sponges, as we shall see better later on, yet it is advisible to have the same term for the same structures in the two groups Halichondrina and Clavulina, and as the term subdermal cavity is already in use we shall retain it in preference to inventing a new one.

In the Halichondrina the subdermal cavities are usually expanded *horizontally* and more or less lacunar in form, being roofed in only by the thin, pore-bearing dermal membrane, and many pores usually lead into one and the same subdermal cavity. The extent to which they are developed varies much in different sponges, attaining its maximum in the genus *Ciocalypta* amongst the Axinellidæ. Here, it will be remembered, the thin dermal membrane is supported at some distance from the choanosome on slender pillars of spiculo-fibre, and the numerous pores lead into one large, continuous subdermal space, interrupted only by these supporting pillars.[1] In certain other Axinellidæ, *e.g.*, *Phakellia*, the subdermal cavities are also largely, but not nearly so largely developed, but this not does appear to be a constant family character.

In most of the Halichondrina, however, the subdermal cavities are rather vague and ill-defined, and distinguishable from the remainder of the lacunar canal system more by their position than by any peculiarities in structure; they show no great regularity either

[1] Bowerbank gives a good figure of this arrangement in Mon. Brit. Spong., vol. i., pl. xxx. fig. 360.

in size or form. Such appears to be the case in *Halichondria panicea*, *Myxilla nobilis*, &c., and in many cases it is extremely difficult to say where the subdermal cavities end and the inhalent canals or lacunæ proper begin.

In *Phakellia* and in *Esperiopsis challengeri* (both of which, it will be remembered, are flabellate sponges with the pores on one surface and the oscula on the other), we find a somewhat peculiar condition. The pores lead directly into large, irregularly conical chambers (*vide* Pl. XLIX. fig. 3), which often extend almost through the entire thickness of the sponge, and from these great chambers, which we may regard as the subdermal cavities in that they are in direct communication with the exterior, the system of small inhalent lacunæ takes its origin. These large, vertically elongated subdermal cavities interdigitate with similar exhalent chambers opening on to the opposite surface (*vide* Pl. XLIX. fig. 3).

In those cases where, owing to special circumstances, the pores are confined to special areas, we find, of course, that the subdermal cavities undergo a corresponding modification. Thus in *Esperella murrayi* the subdermal cavities are narrow, horizontally elongated, branching channels (Pl. XLVIII. figs. 2, 2*a*) underlying the pore-areas, and in this case they are sufficiently distinctly marked off from the true inhalent canals, which lead out of them by narrow openings (Pl. XLVIII. figs. 2, 2*a*).

In the Clavulina (especially the Suberitidæ) we find a good deal more regularity in the form and arrangement of the subdermal cavities, a fact which is undoubtedly due to the presence of a distinct cortex, and to the radiate arrangement of the dermal skeleton. The vertical disposition of the spicules in the cortex prevents extension of the subdermal cavities in a horizontal direction, and they consequently become vertically elongated, and we have here an important distinction between the Suberitidæ and the Halichondrina. The pores usually lead in the first instance each into a narrow, slit-like canal, between radiating bundles of spicules (Pl. L. figs. 1, 3*a*); these canals then expand, several of them often uniting together, and give rise to a wide space which is the chief part of the subdermal cavity (Pl. L. figs. 2, 3*a*, *s.c.*). Sometimes, as in *Latrunculia apicalis* (Pl. LI. fig. 1) and *Stylocordyla stipitata*, var. *globosa* (Pl. L. fig. 1), this cavity cannot be sharply distinguished from the remainder of the inhalent canal system. At other times, however, it is definitely bounded, its vertical limit coinciding with that of the cortex. Of this latter condition it will suffice to give two examples, viz., *Suberites caminatus* and *Tentorium semisuberites*.

In *Suberites caminatus* the condition of affairs is very simple; each pore leads into a separate, elongated subdermal cavity, which, at first very narrow, gradually increases in diameter, and then, as it reaches the commencement of the choanosome, contracts again more suddenly, being thus somewhat flask-shaped; occasionally two of these flask-shaped subdermal cavities appear to run into one another.

In *Tentorium semisuberites* the arrangement is a much more complex one. The subdermal cavities are each divided into three parts corresponding to the three divisions

of the cortex which we have already described (p. xxxi). The pores (Pl. L. fig. 3*a*, *p*) lead by narrow canals through the outer layer of the cortex into expanded, elongated cavities in the middle layer of the cortex, and these on reaching the lower layer of the cortex again contract into narrow canals (Pl. L. fig. 3*a*, *p'*), which at the commencement of the choanosome open into the much wider inhalent canals (Pl. L. fig. 3*a*, *i.c.*). This is the most complex type of subdermal cavity with which we are acquainted.[1]

These are the principal modifications of the subdermal cavities which are met with in the Monaxonida. It will be seen from what has been said that the term is incapable of a sharp definition, and that the subdermal cavities of one sponge do not necessarily correspond strictly to those of another. In the Halichondrina all we can say of them by way of definition is that they are the spaces beneath the dermal membrane into which the pores directly lead, while in the Suberitidæ they are usually represented by so much of the inhalent canal system as is enclosed within the ectosome; and in both cases they may or may not be sharply marked off from the remainder of the inhalent canal system.

(3) The Inhalent Canal System below the Subdermal Cavities.

In this section of the canal system we meet with but little variation amongst the Monaxonida. As a very general rule the inhalent canal system, upon entering the choanosome, becomes converted into a system of lacunar spaces, rather than definite canals. Such we have found to be the case in the genera *Halichondria*, *Reniera*, *Esperella*, *Myxilla*, *Axinella*, *Latrunculia*. If, however, as in the genus *Esperella*, there is a thick, gelatinous ectosome, then the inhalent canals may, after leaving the subdermal cavities, remain perfectly definite while in the ectosome and run straight downwards to the choanosome, where they at once break up into a system of lacunæ. This condition is very well illustrated in *Esperella murrayi;* each inhalent canal (Pl. XLVIII. fig. 2, *i.c.*) leaves the horizontally elongated subdermal cavity by a narrow exit (Pl. XLVIII. fig. 2*a*, *i.c.*) and dips vertically downwards towards the choanosome, upon arriving at which it is at once lost in a system of irregular inhalent lacunæ lined by flagellated chambers. Another interesting feature of the inhalent canals in this sponge is the manner in which their walls are guarded by projecting spicules (Pl. XLVIII. fig. 2*c*), as we have already described.

In *Latrunculia apicalis* the lacunar arrangement is also well illustrated; here we have no long, straight canal interpolated between the subdermal cavity and the choanosome, as in *Esperella murrayi*, but the subdermal cavity into which the pores lead passes directly into a very wide, more or less lacunar channel (Pl. LI. fig. 1), from which numerous

[1] Dr. Vosmaer has also described and figured the subdermal cavities in *Tentorium semisuberites* (Sponges of the "Willem Barents" Expedition, 1880–81, p. 19, pl. iii. fig. 22, &c.). His description agrees in the main with ours, but he appears to have overlooked the important division of the cortex into three distinct layers.

very much smaller lacunar channels take their origin, and from these again smaller ones; and here again the lacunæ are surrounded by the flagellated chambers (Pl. LI. fig. 1*a*).

In *Stylocordyla stipitata*, var. *globosa*, the inhalent canals are also, at any rate near the surface of the sponge, represented by a system of lacunar channels surrounded by the flagellated chambers (Pl. L. fig. 1).

We have in no case found the inhalent canals breaking up into a system of finer and finer canals, of which the ultimate ramifications end each in a single flagellated chamber. This, however, is probably due to the insufficiency of the time and material at our disposal, for such a condition is described by Vosmaer in *Trichostemma* (*Polymastia*) *hemisphæricum*,[1] and, judging from other accounts, of which, however, none are very definite, would appear to occur also in some other Suberitidæ. That it does not occur in all the Clavulina we have already shown; for in *Latrunculia* we have found the lacunar condition as above described, and Poléjaeff informs us[2] that *Suberites domuncula* also is "characterised by an entire absence of special cameral canaliculi."

(4) The Flagellated Chambers.

The flagellated chambers appear, from our researches, to be nearly always globular or subglobular in form in the Halichondrina, and either globular or oval in the Clavulina. In size they vary from about 0·024 to about 0·058 mm. in average diameter.

The following table of measurements and forms as observed by us in eighteen species may be of use in showing the relative sizes and shapes of the chambers in the different groups:—

Species.	Average Diameter of Flagellated Chambers.	Form of Flagellated Chambers.
Halichondria panicea,	0·0336 mm.	Subglobular
Petrosia hispida,	0·0288 „	Globular
Reniera sp.,	0·024 „	Globular
Esperella gelatinosa,	0·0336 „	Subglobular
Esperella fusca,	0·0288 „	Subglobular
Esperella lapidiformis,	0·0288 „	Subglobular or oval
Esperella murrayi,	0·0240 „	Subglobular
Esperiopsis challengeri,	0·0432 „	Subglobular
Myxilla nobilis,	0·048 „	Subglobular
Hymeniacidon caruncula,	0·024 „	Subglobular
Phakellia ventilabrum, var. *connexiva*,[3]	0·0384 „	Subglobular
Axinella (?) *paradoxa*,	0·0336 „	Globular
Raspailia tenuis,	0·0336 „	Oval or subglobular
Suberites caminatus,	0·0336 „ (but variable)	Oval or subglobular
Stylocordyla stipitata, var. *globosa*,	0·0336 „	Subglobular or elongated
Tentorium semisuberites,	0·058 „	Oval
Spirastrella massa,	0·0288 „	Subglobular
Latrunculia apicalis,	0·0336 „	Subglobular

[1] Sponges of the "Willem Barents" Expedition, 1880–81, p. 13.

[2] Zool. Chall. Exp., part xxxi., Report on the Keratosa, p. 80.

[3] It is of especial interest to have succeeded in finding the flagellated chambers in this sponge, as both Vosmaer and

Owing to the shrinking and distortion of the chambers from the action of the spirit it is not easy to arrive at very certain conclusions either as to their form or size; probably in many cases in which a chamber now appears to be oval this shape is chiefly due to lateral pressure; and it is noteworthy in this connection that the elongated form is most commonly to be observed in corticate sponges, which, owing to the presence of the fibrous tissue, probably contract more strongly when put into spirit than the non-corticate species.

Within the species the size of the chambers appears usually to be very fairly constant, but the above table seems to indicate that it is not likely to prove of much value for systematic purposes, except perhaps occasionally in the distinction of species or at the most of genera.

Mr. Carter[1] has already pointed out that the diameter of the chambers ("ampullaceous sacs") is about 1–600th of an inch (=0·042 mm.)[2] in the siliceous sponges, and also that in this group they are for the most part globular, results which agree very well with those above given by us.

As a rule the chambers in the Monaxonida are embedded in trabeculæ of mesodermal tissue which separate the ultimate inhalent lacunæ from the ultimate exhalent lacunæ, and they open into the latter by wide mouths (*e.g.*, *Esperella murrayi*, Pl. XLVIII. fig. 2*d*; *Axinella* (*?*) *paradoxa*, Pl. XLIX. fig. 2; *Latrunculia apicalis*, Pl. LI. fig. 1*a*). In *Stylocordyla stipitata*, var. *globosa*, we have, however, at any rate occasionally, narrow exhalent canaliculi leading away from the flagellated chambers (*cf.* Pl. L. fig. 1*a*), a condition which appears to be much more distinctly pronounced in *Polymastia* (*Weberella*) *bursa*, as described and figured by Vosmaer.[3]

Hansen have suggested that they are absent. Vosmaer, speaking of *Phakellia bowerbanki*, expresses himself very guardedly:—"Also in *Phakellia bowerbanki* I could not detect ciliated chambers. As long as I have not studied *Phakelliæ* which I have preserved myself, being sure that they were living in the moment they came in alcohol, I will not pretend that they really do not exist. But it may be suggested here as a possible fact, that those thin fan-shaped sponges are destitute of them because they do not want them. Every good section shows us that the water can flow through and through the body, the natural movement of the water being probably sufficient for bringing new living material to the sponge (fig. 12)" (Sponges of the "Willem Barents" Expedition, 1880–81, p. 24, 1885). The idea that the water can flow right through from side to side, as indicated here and in Vosmaer's figure, must have arisen from the badness rather than the goodness of the sections (*cf.* Pl. XLIX. fig. 3). Hansen expresses himself with much more confidence concerning his researches on the subject:—"Nach diesen Resultaten der Untersuchung muss man annehmen, dass das Wasser durch die Kanäle strömt ohne durch Flimmerbewegung fortgeleitet zu werden; die Oeffnungen an der Oberfläche kann man demnach als Ostien oder Poren bezeichnen je nach Belieben; sie functionieren wahrscheinlich als beides zugleich. Da die Phakellien meistens dünne Platten bilden, die fast wie ein Sieb durchlöchert sind, wird es kaum schwierig zu verstehen, dass ihnen Nahrung zugeführt werden kann einfach durch die Wasserströmung ohne dass es nöthig wäre diese Strömung durch besondere Einrichtungen zu fördern." (Bergens Museums Aarsberetning for 1885, Bergen, 1886). And this, notwithstanding the fact that Hansen has "keine Schwierigkeit gehabt frisches Material zu beschaffen." The flagellated chambers in *Phakellia ventilabrum*, var. *connexiva* are perfectly distinct and closely crowded together (*vide* Pl. XLIX. fig. 3), and there cannot be the slightest doubt that they are present also in other species of the genus.

[1] *Ann. and Mag. Nat. Hist.*, ser. 4, vol. xvi. p. 22.

[2] Not 0·42 mm. as given by Vosmaer (Bronn's Klass. u. Ordnung. d. Thierreichs, Porifera, p. 129), which is probably a misprint.

[3] Sponges of the "Willem Barents" Expedition, 1880–81, p. 17, pl. iii. fig. 9.

We have never succeeded in detecting the inhalent openings of the chambers, nor, so far as we are aware, has any one else done so in a Monaxonid sponge. Possibly this is due partly to the fact that they are excessively minute and close up almost or quite entirely when the sponge is treated with reagents; and also to the difficulty in obtaining very thin sections of siliceous sponges. That they exist there can be no reasonable doubt, and there is no need for us to take refuge in the novel theory, recently propounded by Mr. Carter,[1] that the flagellated chambers ("ampullaceous sacs") have each only a single opening.

(5) The Exhalent Canal System.

We have been obliged, in speaking of the flagellated chambers, somewhat to forestall our observations on the exhalent canal system, and we have little to add. It is usually, at any rate in its finer ramifications, lacunar like the inhalent system; so that we have a system of interdigitating, ramifying lacunæ, some inhalent and some exhalent, separated from one another by the mesodermal tissues in which the flagellated chambers are embedded. This appears to be always the condition in the Halichondrina (Pl. XLVIII. fig. 2*d*; and Pl. XLIX. fig. 2), and, sometimes at any rate, in the Clavulina (Pl. LI. fig. 1*a*). But, as already pointed out, we may also, in the Clavulina, find narrow exhalent canaliculi leading away from the flagellated chambers, as in *Stylocordyla* (Pl. L. fig. 1*a*) and *Polymastia* (*Weberella*) *bursa*. The small exhalent channels gradually unite together into wider and wider and usually more and more definite canals, which ultimately open on to the surface at the oscula. Even in species in which the ultimate ramifications of the exhalent system are lacunar, the larger canals are usually perfectly distinct and definite, as, for example, in *Esperella murrayi* (Pl. XLVIII. fig. 2, *e.c.*) and *Latrunculia apicalis* (Pl. LI. fig. 1); and they are occasionally (*e.g.*, *Spirastrella solida*) provided with very definite, circular diaphragms, occurring at intervals, for the purpose of regulating the outflow of the water; while at other times (*e.g.*, *Latrunculia apicalis* and *Stylocordyla stipitata*, var. *globosa*) they are surrounded by a sheath of fibrous tissue which probably serves the same purpose.

(6) The Oscula.

The structures described under this name by various authors are not, in many cases, as pointed out already by Vosmaer, homologous one with another. Indeed, in the present state of our knowledge it is impossible to unravel the intricate question of the homologies of the oscula. In this work we shall, therefore, use the term in a purely

[1] *Ann. and Mag. Nat. Hist.*, ser. 5, vol. xix. p. 203, *et seq.*

empirical sense to designate the openings on the surface of the sponge through which the water is discharged from the canal system. In this sense the word is now generally understood.[1]

Thus in the case of tubular sponges, like *Siphonochalina* (Pl. VII.), the osculum is the large opening at the top of each tube. In the case of cup-shaped sponges, however, such as *Tedania infundibuliformis* (Pl. XI. fig. 1), we cannot call the wide expanded mouth of the funnel an osculum, although probably it is homologous with the opening of the tube in *Siphonochalina*. In flabellate sponges, as we have already had occasion to point out (p. xxxix), the oscula are usually confined to one surface; these flabellate forms by folding round give rise to funnel-shaped sponges—*e.g.*, *Phakellia ventilabrum* and *Phyllospongia* (which may be either flabellate or cup-shaped),—in which the oscula are usually situated on the inner surface of the funnel. By a further extension of the same process the sponge becomes tubular, with a comparatively narrow opening at the top which we now call the osculum. How far this folding and complication may be carried we do not know.

The oscula in the Monaxonida vary very greatly in size ;[2] they may either be small and abundant (*e.g.*, *Petrosia hispida*, Pl. III. fig. 2 ; *Phakellia ventilabrum*, var. *connexiva*, Pl. XLIX. fig. 3; *Esperiopsis challengeri*, Pl. XVIII. fig. 1 ; *Homœodictya grandis*, Pl. XXII. figs. 1, 1*b*, &c.), or large and comparatively few (*e.g.*, *Esperella murrayi*, Pl. XIV. figs. 1, 1*a*, *Spirastrella papillosa*, Pl. XLI. fig. 5, &c.). They are very commonly found on the uppermost part of the sponge, as in *Halichondria latrunculioides* (Pl. I. fig. 5), *Esperella murrayi* (Pl. XIV. figs. 1, 1*a*), *Spirastrella solida* (Pl. XLI. fig. 7), &c., but their distribution is very variable. Their form also varies much ; they may either have their margins level with the general surface of the sponge and not surrounded by any raised collar, as, for example, in *Pachychalina* (*?*) *punctata* (Pl. VI. fig. 2), or they may be surrounded each by a membranous collar, as in *Esperella lapidiformis* (Pl. XVI. figs. 2, 2*b*), or they may be raised on the summits of papillæ, as in *Latrunculia apicalis* (Pl. XLIV. fig. 4 ; Pl. LI. fig. 1). They may be merely the openings of shallow, basin-like depressions, into which numerous exhalent canals discharge by numerous small mouths, as in *Pachychalina fibrosa* (Pl. IV. fig. 3); or they may be the openings of long, wide canals coming up from deep in the body of the sponge, as in *Latrunculia apicalis* (Pl. LI. fig. 1). Sometimes they are arranged in stellate groups, a condition which appears to be most common in flabellate sponges (*e.g.*, *Homœodictya grandis*, Pl. XXII.; and *Phakellia flabellata*, Pl. XXXIV. fig. 3*a*); or, again, there may be only a single osculum to each individual, as in *Stylocordyla* (Pl. XLIII. fig. 10).

[1] *Cf.* Vosmaer, Bronn's Klass. u. Ordnung. d. Thierreichs, Porifera, p. 127.

[2] For measurements see the Description of Genera and Species.

Lastly the sponge may be lipostomous, *i.e.*, without any visible oscular openings at all; such appears to be the case, commonly at any rate, in the deep-sea genera, *Cladorhiza* and *Chondrocladia* (Pl. XX.).

General Remarks on the Canal System.

We may briefly sum up our more important conclusions with regard to the canal system of the Monaxonida as follows:—

(1) The arrangement of the pores varies almost indefinitely, being to a large extent dependent either directly or indirectly (through the dermal skeleton), upon the external conditions under which the species lives. They may be scattered all over the sponge or localised in more or less definite areas.

(2) The canal system in the Halichondrina, usually if not always, belongs to Vosmaer's third type,[1] that is to say, it is more or less lacunar, and the flagellated chambers open by wide mouths into wide exhalent lacunæ. In the Clavulina the canal system may belong either to the third or fourth[2] types; in the latter case the flagellated chambers are provided with special "cameral canaliculi."

Thus our general conclusions with regard to the type of the canal system are quite in accordance with those of Vosmaer[3] and Poléjaeff.[4] It is true that two naturalists have attempted to establish the existence of a racemose type of canal system in Halichondrine sponges. Keller's attempt[5] in the case of *Reniera semitubulosa* has been already severely criticised by Poléjaeff,[6] who comes to the conclusion that "the observation of this naturalist on the structure of *Reniera semitubulosa*, executed under the influence of Professor Haeckel's statements on the non-existing racemose type of the canal system" is "unreliable"; a conclusion which we cannot but endorse. The second attempt does not appear to have attracted much attention, and certainly does not deserve to do so; for, whatever may be the sponge which Saville Kent[7] mentions under the name *Esperia* sp., we are confident that it never had a canal system of the quite impossible kind figured, in which the diameter of the flagellated chambers is about twice that of the pores, and there are (to judge from the figure) no exhalent canals whatever.

[1] *Vide* Bronn's Klass. u. Ordnung. d. Thierreichs, Porifera, p. 130.
[2] *Loc. cit.*
[3] Bronn's Klass. u. Ordnung. d. Thierreichs, Porifera, p. 335.
[4] Zool. Chall. Exp., part xxxi., Report on the Keratosa, p. 80.
[5] *Zeitschr. f. wiss. Zool.*, Bd. xxx. p. 579, pl. xxxvii. fig. 1.
[6] Zool. Chall. Exp., part xxxi., Report on the Keratosa, p. 79.
[7] Manual of the Infusoria, vol. i. p. 169, pl. vii. fig. 2.

B. Embryological Notes.

We had at first intended to give a somewhat detailed account of a number of embryos which we have met with in the course of our work, but after consulting the literature[1] bearing upon this much vexed portion of our subject, we have decided that it is desirable to say as little as possible. There are already so many contradictory opinions with regard to the development of the sponges, and, according to Heider, it is so extremely unsafe to draw conclusions from specimens that have been preserved in spirit, that, for fear of adding to the already existing confusion, we naturally feel very diffident about recording our observations; we shall, therefore, make our remarks on this head very short.

Concerning the position in which the embryos develop in the sponge, the most interesting point seems to be that, as might be expected, they always develop in the position of greatest security. In large, massive sponges it is obvious that, so long as they do not lie very near to the surface, the position is a matter of no very great importance, and accordingly in *Esperella lapidiformis, e.g.*, we find them scattered through the choanosome in groups, commencing a short distance below the surface of the sponge (Pl. XVI. fig. 2*a*, *e*). In small and delicate species, however, the position becomes a matter of considerable importance; thus in *Esperella biserialis*, where the sponge consists of a central spicular axis coated by only a thin layer of soft tissues, we find the embryos (Pl. XIV. fig. 3, *e*) taking refuge in the centre of the spicular axis. Again in *Esperella mammiformis*, a hemispherical sponge (Pl. XIV. figs. 5, 6) with flat base attached to stones, the embryos are found grouped close to the stone near the centre of the base. In *Chondrocladia crinita*, a "Crinorhiza" form (Pl. XX. fig. 4), the embryos again occur in the soft tissues near the centre of the sponge, and each appears to be surrounded by a dense mass of the characteristic isochelæ of the species.

The ova are, of course, developed from amœboid mesodermal cells, and it appears from our observations on *Esperella lapidiformis* (*vide* p. xxxi) that they may originate either in the choanosome or the ectosome (the latter being gelatinous), but that they develop only in the choanosome, whither we must imagine that those which originate in the ectosome migrate. The free-swimming larva escapes from the parent sponge through the exhalent canals, as is well shown in some of our preparations of *Esperella murrayi* (*vide* Pl. XLVIII. fig. 2, *e*).

The commonest type of embryo met with by us is that which occurs in *Esperella*

[1] *Cf.* Carter, Development of Marine Sponges, *Ann. and Mag. Nat. Hist.*, ser. 4, vol. xiv. p. 321, *et seq.*; Keller, Studien über Organization u. Entwickelung der Chalineen, *Zeitschr. f. wiss. Zool.*, Bd. xxxiii. p. 317; Marshall, Die Ontogenie von Reniera filigrana, *Zeitschr. f. wiss. Zool.*, Bd. xxxvii. p. 221; Schulze, Die Familie der Spongidæ, *Zeitschr. f. wiss. Zool.*, Bd. xxxii. p. 593; Sollas, On the Development of Halisarca lobularis, *Quart. Journ. Micr. Sci.*, N.S., vol. xxiv. p. 603; Heider, Zur Metamorphose der Oscarella lobularis, *Arb. zool. Inst. Wien*, Bd. vi., Heft 2, p. 175; &c.

mammiformis, nobis. In the particular stage referred to the larva is more or less spherical in form, and composed of an outer (? single) layer of small, ciliated, ectodermal cells, and a central mass of much vacuolated tissue. The central mass of tissue has probably been a good deal affected by the action of the spirit; it appears now to consist of strings of plasma (apparently composed largely of stellate cells) containing numerous spherical nuclei and nucleoli. Probably in the living embryo this central mass was composed of a continuous, structureless, gelatinous matrix with embedded stellate cells, like the ground substance of the adult sponge, but more delicate. Conspicuous in it are numerous stylote and anisochelate spicules, arranged apparently without any order. The palmate anisochelæ are more numerous and appear to have reached a higher state of development than the styli. They average about 0·05 mm. in length as against 0·072 mm. in the adult sponge. The styli on the other hand measure only about 0·34 by 0·005 mm., as against 1·0 by 0·019 mm. in the adult.

The entire embryo measures up to nearly 1·0 mm. in diameter, and is enclosed in a membranous capsule. The ectodermal layer in three specimens which we have examined at about this stage exhibits foldings or invaginations which may or may not be due to the action of the spirit.

In a younger embryo of the same sponge we have been able to trace the development of the palmate anisochelæ, as recorded on p. xx.

In *Esperella biserialis* the embryos found in the spicular axis of the sponge agree essentially with those just described for *Esperella mammiformis*, *i.e.*, they consist of an irregular sphere of small ectodermal cells enclosing a central mass of tissue with numerous spicules. In one embryo, however, the ectodermal layer appears to be absent from one pole, at which the central mass of tissue comes to the surface. The embryos are again enclosed in membranous capsules.

In *Myxilla nobilis* we have found numerous embryos in various stages of development, amongst which a stage corresponding with that first described is again common. The embryo, about 0·24 mm. in diameter, consists of a sphere of ectoderm, which may be invaginated in many places, composed of small, prismatic (?) cells, enclosing a mass of tissue, in this case rather compact, containing numerous megasclera and microsclera. It is important to observe that the styli of the embryo, which are usually arranged in a single dense sheaf with their bases all together at one side of the embryo and their apices projecting into the centre, are all entirely spined and resemble the echinating styli of the adult sponge, and not the large styli, which in the adult are entirely smooth or only very slightly spined at the base (*vide* p. 141). They are straight, and gradually and sharply pointed, sometimes with distinct heads, and measure about 0·11 by 0·005 mm. The chelæ appear to develop before the styli. The characteristic arrangement of the megasclera in the embryo appears to have already been noted by Carter in an embryo of a siliceous sponge.[1]

[1] *Ann. and Mag. Nat. Hist.*, ser. 4, vol. xiv. p. 333, pl. xxii. fig. 28, *e*.

It thus appears that there is one developmental stage fairly constant in the Halichondrina, in which the embryo consists of a sac of small, probably prismatic, ciliated ectodermal cells, enclosing a central mass of mesodermal (?) tissue containing the developing spicules. In some cases, perhaps in all (for it would be difficult owing to the nature of the case to make sure of the contrary) the ectoderm appears to be absent from one pole, at which the mesoderm (?) comes to the surface. This stage probably nearly corresponds with one figured by Keller for his *Chalinula fertilis*,[1] by Carter for *Halichondria simulans* and *Esperia ægagropila*,[2] by Marshall for *Reniera filigrana*,[3] and by Schulze for *Euspongia officinalis adriatica*.[4]

There is one other type of embryo, observed by us in *Esperella lapidiformis* only, which seems worth noticing in this place. The embryos (Pl. XVI. fig. 2*a*, *e*) are very numerous, more or less spherical, measuring about 0·5 mm. in diameter. Each is enclosed in a membranous capsule, and is composed mainly of a dense, solid, finely granular mass of tissue (Pl. XLVIII. fig. 1, *a*), with small nucleoid bodies scattered through it. This structure prevails throughout the embryo excepting at one pole, where there is a hemispherical cap of large cells (Pl. XLVIII. fig. 1, *c*), appearing in sections to be polygonal from mutual pressure, each with a large oval nucleus (*n*), about 0·01 mm. in longer diameter, and a nucleolus. The cap of cells appears sometimes to be slightly shrunk away by the action of the spirit from the remainder of the embryo. This would seem to be a much earlier stage of development than those above described; there are as yet no traces of spicules.

[1] *Zeitschr. f. wiss. Zool.*, Bd. xxx., pl. xix. fig. 15.
[2] *Ann. and Mag. Nat. Hist.*, ser. 4, vol. xiv., pl. xxi. figs. 21, 22, 25.
[3] *Zeitschr. f. wiss. Zool.*, Bd. xxxvii., pl. xiv. figs. *b*, *c*.
[4] *Zeitschr. f. wiss. Zool.*, Bd. xxxii., pl. xxxviii. fig. 4.

CHAPTER III.—THE CLASSIFICATION OF THE MONAXONIDA.

I. The Data of Classification.

That the detailed classification of any group of sponges would be a difficult task, one might be led to suppose on *à priori* grounds alone, from the consideration of the low position which sponges occupy in the animal kingdom, or, in other words, from the consideration of their low degree of specialisation and the consequent scarcity of definite distinguishing characters. No two sponges are exactly alike, and yet all the so-called species in a genus resemble one another so nearly, and are so often still connected by intermediate forms, that the distinction of species often becomes purely an arbitrary question and a matter of individual judgment. The characters of the species do not appear to be nearly so firmly fixed as in higher groups, they seem to be in a very plastic condition, and capable of almost infinite modification according to their surroundings.

This being so it is obvious that we must, for purposes of classification, endeavour to discover those structures in a sponge which are least subject to modification. That external form is useful for this purpose only to a very limited extent, and when the utmost caution is exercised, is now agreed on all hands. If further proof be needed of this fact the Challenger collection supplies it in abundance, and it is perhaps worth our while to give one remarkable illustration.

We shall describe in the systematic portion of the present work a number of species shown by their spicules to belong to three distinct genera, viz., *Cladorhiza*, *Chondrocladia*, and *Axoniderma*, all characterised by the same external form, and that a very remarkable one. In brief, each sponge consists of a small, subglobular or conical body provided with an equatorial zone of long, stiff, supporting processes. To this peculiar external form (*vide* Pl. XX. figs. 2, 4, 5, 7, 8) we have given the name "Crinorhiza form"; all sponges as yet known to possess it come from very great depths and live on a bottom of soft mud or ooze, and there can be no doubt that the long, radiating processes, usually associated with a single vertically descending, central, root-like process, are for the purpose of supporting the sponge and preventing it from sinking into the soft mud on which it lies. We only find the Crinorhiza form in species which live in very deep water; species of the same genera which inhabit shallower water do not possess it.

It would be an easy matter to adduce further instances in support of the same law, namely, that similar external conditions beget similar external forms even in species of distinct genera, but it is needless to multiply proof. Moreover, the external form of one and the same species (as shown by its spiculation) varies greatly, sometimes with no apparent reason at all, as, for example, in *Petrosia similis*, nobis (Pl. III. figs. 3, 4).

We must then look elsewhere than to external form for a guide to classification.

Bowerbank thought that he had discovered the great desideratum in the arrangement of the skeleton, and his subfamilies and genera were consequently made to depend solely upon this character. But a glance at his system shows the utter failure of such an attempt. Let us take an example from his work:[1]—"*Order II.* Silicea. *Suborder I.* Spiculo-radiate skeletons. Not reticulate. Composed of spicula radiating in fasciculi or separately from the base or axis of the sponge." In this suborder Bowerbank places the following genera:—

1. *Geodia* (Tetractinellid).
2. *Pachymatisma* (Tetractinellid).
3. *Ecionemia* (Tetractinellid).
4. *Alcyoncellum* (Hexactinellid).
5. *Polymastia* (Monaxonid).
6. *Halyphysema* (Foraminifer).
7. *Ciocalypta* (Monaxonid).
8. *Tethea* (partly Tetractinellid).
9. *Halicnemia* (Monaxonid?).
10. *Dictyocylindrus* (Monaxonid).
11. *Phakellia* (Monaxonid).
12. *Microciona* (Monaxonid).
13. *Hymeraphia* (Monaxonid).
14. *Hymedesmia* (Monaxonid).

Such is the result of applying the arrangement of the skeleton as a sole guide to the distinction of genera; we need say no more.

But although the arrangement of the skeleton cannot be applied by itself to the distinction of genera, yet it is by no means valueless as a guide to classification when taken in conjunction with other characters, especially when applied to larger subdivisions than genera. Thus, in the more careful and discriminating hands of Mr. Carter it has led to much better results; the Axinellidæ, Ectyoninæ, and Suberitidæ, being all characterised by special types of skeleton arrangement fairly constant within the group; still it is at the best an uncertain guide.

Hitherto a great deal of reliance has been placed upon the greater or less amount of spongin, or horny cementing material, present in the skeleton, but of late years this character also has been losing favour amongst spongologists. Indeed, as has already been pointed out, it is the great merit of Dr. Gray's system that in it the horny sponges are included amongst the Silicea. Dr. Gray was, however, a good deal in advance of his times in this respect. We hope to show in this place that even within the group of Monaxonida the amount of spongin present varies in such an irregular fashion as to be of comparatively little use for purposes of classification.

In all the Halichondrina spongin is usually present, and we find that the amount stands, roughly speaking, in inverse proportion to the number of spicules. Thus, taking first the Homorrhaphidæ, the division between the Renierinæ and Chalininæ is a purely arbitrary one; both groups contain more or less spongin, very few (if any) species even of Renierinæ containing none, while in the Chalininæ the amount is relatively very large.

[1] Mon. Brit. Spong., vol. i. pp. 159, 167, &c.

The form of the spicules in both groups is exactly the same. Hence there is good reason for supposing that the Chalininæ have been derived from the Renierinæ by the development of spongin at the expense of the spicules, and, moreover, they seem to be of polyphyletic origin, descended from several distinct genera of Renierine sponges.

In the Heterorrhaphidæ we find examples of exactly the same thing. The genus *Gelliodes* differs from the genus *Gellius* only in the greater development of horny fibre, and the genus *Toxochalina* contains so much spongin in the fibre that it has hitherto been placed amongst the Chalininæ, although its spiculation shows it to be one of the Heterorrhaphidæ.

Amongst the Desmacidonidæ we have abundant instances. We have species of the genus *Esperella* with little or no horny matter, and other species with a well-developed horny skeleton, and precisely the same thing occurs in the genus *Myxilla*. *Clathria* and *Echinoclathria* are other instances of genera of the Desmacidonidæ in which there is a very highly developed horny skeleton.

In the Axinellidæ the same facts may again be observed, and the Challenger dredgings have brought to light a highly instructive example of an Axinellid sponge (*Axinella fibrosa*, nobis) possessed of a very strongly developed horny skeleton.

We have already remarked the fact that the siliceous skeleton decreases in proportion as the horny skeleton increases, until ultimately it disappears and leaves us face to face with a horny sponge. No wonder then, considering their probable origin from many distinct groups of siliceous sponges, that Poléjaeff found such great difficulty in classifying his Keratosa.

We must mention in this place another very suggestive and important fact with regard to spongin, and that is, that its degree of development depends upon locality. Sponges with horny fibre are far and away more abundant in tropical or subtropical seas than in temperate or frigid areas. When a sponge gets into a warm area it tends to develop horny fibre. This is true at least of the Halichondrina amongst Monaxonida, as is sufficiently shown by a glance at our tables of geographical distribution and the description of those species obtained from the warmer areas.

As regards the value of the minute anatomy and histology from a systematic point of view we are hardly able as yet to form any conclusions, for our knowledge of this subject is at present in its earliest infancy. We have in the last chapter given details on this head which will, we hope, ultimately be of use in settling the question; at present all we can do is to collect information. So far as our researches yet go it seems that the nature of the ectosome, *i.e.*, whether it forms a fibrous cortex or exists as a thin dermal membrane or as a thick gelatinous layer, is likely to be of great systematic value. Amongst the Halichondrina we know of only a single instance, the genus *Phelloderma*, nobis, in which the ectosome forms a distinct, fibrous cortex, whilst amongst the Clavulina a distinct, thick, fibrous cortex is almost invariably present. The arrangement of the

pores we have shown to be almost utterly untrustworthy except for specific distinctions, and we are inclined to set very little value, except for purposes of a most general nature upon the fundamental arrangement of the canal system, that is to say, whether it belongs to Vosmaer's third or fourth type, for the simple reason that in nearly every Monaxonid sponge as yet worked out (and we believe also in the Keratosa) it belongs to the former. Still, although the same *fundamental* type of arrangement will probably be found to prevail throughout the group, yet it is also probable that many minor differences in the canal system of different genera will be discovered, and will prove to be of great systematic value. As examples of such minor differences we may point to the characteristic arrangement of the larger inhalent and exhalent canals in the genus *Phakellia*, and the arrangement of the inhalent canal system in the genus *Esperella*, as already described by us, in both of which genera the canal system differs in the respects mentioned from the more common Halichondrine type found in *Halichondria*, &c. As another example we may note the presence of distinct sphincters or diaphragms in the larger exhalent canals of the genus *Spirastrella*, which seems to be a fairly constant generic character.

We come now to the consideration of the spicules, and of the two categories of these we will take first the megasclera, which we shall find to be of very great service in classification. The same form of megasclera is found to run through large divisions; thus, in the family Homorrhaphidæ, comprising the Renierinæ and Chalininæ, we find only smooth oxeote megasclera and no microsclera. In the Clavulina, again, the megasclera are almost all tylostylote or stylote. But here we occasionally meet with startling exceptions, one of the most striking being the genus *Stylocordyla*, a corticate sponge, agreeing in skeleton arrangement, &c., with other Clavulina, but always with oxeote spicules. In the Heterorrhaphidæ and Desmacidonidæ the form of the megasclera is very variable, but we can always use it for purposes of generic distinction. The size of the megasclera is of very slight use save for distinguishing species, but here it is of the greatest value, especially in groups like the Homorrhaphidæ, where even the different genera have all the same form of spicule.

The microsclera, when present, are of still greater systematic value than the megasclera; indeed they form the best guides to the classification of the Monaxonida. The reason of this is probably that they are not subject to modification to suit the external conditions of the sponge; and, further, they are usually more complex in form, and thus present more points of possible difference than do the megasclera. Their use in the economy of the sponge is probably very slight; in many cases we can hardly believe, from their minute size and irregular arrangement, that they have any, and hence there appears to be no reason why they should undergo much modification with changing conditions.[1] The structures which we have hitherto considered are, on the other hand,

[1] "It is a strange result which we thus arrive at, namely, that characters of slight vital importance to the species, are the most important to the systematist;" Darwin, Origin of Species, ed. 6, p. 176.

all of the greatest importance to the sponge, and subject to great modification with every change in external conditions. Of this we have abundant proof; we have seen already how sponges in warm climates tend to develop much spongin, while the megasclera gradually become fewer in number and less in size. We have also shown that the arrangement of the pores is largely dependent on the arrangement of the dermal skeleton and varies with this, and so forth. But the form of the microsclera does not appear to be dependent upon external conditions or upon any other part of the organisation, and hence we find in them great constancy. Let us take, for example, the large family of the Desmacidonidæ. In this family we find megasclera of several distinct types, and their arrangement in the skeleton varies much; the arrangement of the pores varies enormously, and the external form if possible varies even more. But throughout the whole family we find one and the same fundamental form of microsclera (chelæ), commonly associated with others. These chelæ are such remarkable and complex forms that we cannot possibly imagine that they have arisen independently in the different subfamilies and genera, and hence we are obliged to place all these together and separate them from the remainder of the Monaxonida, none of which possess chelæ.

To sum up briefly, the result of our investigation is as follows:—(1) We must always endeavour to classify by an assemblage of characters; (2) of individual characters the form of the microsclera (when present) is the most important, and this owing to the fact that these are subject to less modification than other parts of the organism.

II. The Classification of the Monaxonida here adopted.

Having thus investigated the data of classification and arrived at certain conclusions with regard thereto, we must now set forth the results to which these conclusions have led us in classifying the Challenger collection, and then discuss the mutual relations of the various subdivisions.

In the following scheme of classification we shall mention only those genera which are present in the collection, as the time at our disposal is not sufficient to enable us to give a complete *resumé* of this very intricate subject. The Challenger collection is, however, very fairly complete as regards genera, and quite sufficiently so to justify this proceeding, and although other genera are not here mentioned it must not therefore be thought that we have ignored them in considering the question. The present scheme is based upon the schemes of previous writers, which have been more or less assimilated and modified in accordance with our increase of knowledge.

For the sake of brevity we have also decided to omit in this place all diagnoses; these will be found given fully in the Description of Genera and Species, to which the reader is referred.

Order MONAXONIDA (p. 1).[1]

Suborder I. HALICHONDRINA (p. 1).

Family I. HOMORRHAPHIDÆ (p. 1).

Subfamily 1. RENIERINÆ (p. 1).

Genera—

Halichondria (p. 1). | *Petrosia* (p. 9).
Reniera (p. 14).

Subfamily 2. CHALININÆ (p. 18).

Genera—

Pachychalina (p. 19). | *Chalina* (p. 25).
Siphonochalina (p. 29).

Family II. HETERORRHAPHIDÆ (p. 31).

Subfamily 1. PHLŒODICTYINÆ (p. 31).

Genera—

Rhizochalina (p. 32). | *Oceanapia* (p. 36).

Subfamily 2. GELLIINÆ (p. 37).

Genera—

Gellius (p. 37). | *Gelliodes* (p. 47).
Toxochalina (p. 49).

Subfamily 3. TEDANIINÆ (p. 50).

Genera—

Tedania (p. 50). | *Trachytedania* (p. 57).

Subfamily 4. DESMACELLINÆ (p. 58).

Genus *Desmacella* (p. 58).

Subfamily 5. HAMACANTHINÆ (p. 59).

Genus *Vomerula* (p. 59).

[1] The pages referred to are those on which the diagnoses will be found.

Family III. DESMACIDONIDÆ (p. 62).

Subfamily 1. ESPERELLINÆ (p. 62).

Genera—

Esperella (p. 62).
Esperiopsis (p. 76).
Cladorhiza (p. 86).
Axoniderma (p. 96).
Chondrocladia (p. 99).
Desmacidon (p. 103).
(*Homœodictya* (p. 108)).
Artemisina (p. 112).
Phelloderma (p. 113).
Sideroderma (p. 114).
Iophon (p. 116).
Amphilectus (p. 123).

Subfamily 2. ECTYONINÆ (p. 128).

Genera—

Myxilla (p. 128).
Clathria (p. 146).
Rhaphidophlus (p. 151).
Plumohalichondria (p. 155).
Plocamia (p. 157).
Acarnus (p. 159).
Echinoclathria (p. 159).
Agelas (p. 163).
Echinodictyum (p. 164).

Family IV. AXINELLIDÆ (p. 166).

Genera—

Hymeniacidon (p. 166).
Phakellia (p. 169).
Ciocalypta (p. 173).
Acanthella (p. 176).
Axinella (p. 178).
Raspailia (p. 188).
Dendropsis (p. 191).
Thrinacophora (p. 193).

Suborder II. CLAVULINA (p. 196).

Family I. SUBERITIDÆ (p. 197).

Genera—

Suberites (p. 197).
Polymastia (p. 210).
Proteleia (p. 214).
Trichostemma (p. 216).
Tentorium (p. 221).
Stylocordyla (p. 222).
Quasillina (p. 225).
Cliona (p. 227).

Family II. SPIRASTRELLIDÆ (p. 229).

Genera—

Spirastrella (p. 229).
Latrunculia (p. 233).

III. Discussion of the Different Subdivisions.

The Monaxonida thus comprise two fairly natural suborders, the Halichondrina and the Clavulina. But whether these two suborders are sufficiently closely related to one another and sufficiently distinct from other suborders to admit of their being united in one natural order, the Monaxonida, as opposed to the Tetractinellida, is very doubtful. In the classification of Dr. Vosmaer the order Monaxonida finds no place, and we are inclined to agree with this authority, who accepts the suborders Halichondrina and Clavulina as themselves natural, but refuses to allow a special order for the reception of these two groups to the exclusion of others. There is much evidence in favour of this view. The mere possession by the Tetractinellida of tetraxonid spicules is no safe guide. Imperfectly developed "grapnel spicules," which in a more highly developed condition are so characteristic of Tetractinellid sponges, are now known to occur in the Suberitidæ (*Proteleia*), and polyaxonid megasclera are occasionally met with in Desmacidonidæ and Axinellidæ (*Acarnus* and *Thrinacophora*). Again, the test whether a sponge is corticate or not breaks down utterly in this case, for the Clavulina, like some of the Tetractinellida, are nearly all corticate and have mostly a radially disposed skeleton. We even find a cortex, associated with a radially disposed skeleton, in one genus of Desmacidonidæ (*Phelloderma*). It is quite certain that there exists no sharp line of division between the Monaxonida and the Tetractinellida, for the Suberitidæ, Spirastrellidæ and Tethyadæ supply us with abundant connecting links.

That either the Tetractinellida have been derived from the Monaxonida, or *vice versâ*, is now a generally accepted fact, but which is the parent group is a matter of much controversy, and there is much to be said on both sides. We have already[1] advanced strong reasons for supposing the Tetractinellida to be derived from the Monaxonida, whilst Vosmaer upholds the contrary hypothesis. The time has as yet scarcely arrived when a satisfactory discussion of the question is practicable. We must wait for more evidence, and the evidence chiefly to be desired is of an embryological character. In any case it appears to us that the Clavulina and Tetractinellida are at any rate as intimately connected with one another as are the Clavulina and Halichondrina.

That the Keratosa are most closely connected with the Halichondrina is also now a generally accepted fact, which finds its expression in recent classifications. They are probably Halichondrine sponges, which, living in warm seas, have developed a large amount of spongin, and suffered a correspondingly great reduction in the proportion of spicules present in the skeleton. We can trace this development of spongin through all intermediate stages; through the Renierinæ to the Chalininæ, and thence to aspiculous forms. But this is not the only path by which the same results may have been arrived at. The Challenger dredgings teach us that a horny skeleton may be developed in the

[1] *Ann. and Mag. Nat. Hist.*, ser. 5, vol. xviii. p. 152, *et seq.*

Homorrhaphidæ (Chalininæ), in the Heterorrhaphidæ (*Gelliodes*, *Toxochalina*), in the Desmacidonidæ (*Esperella*, &c.), and in the Axinellidæ (*Axinella fibrosa*), hand in hand with a corresponding reduction in the siliceous element. We thus know four distinct paths along which the Keratosa may have developed, and the group is thus shown to be probably of polyphyletic origin, and, consequently, unnatural.[1]

This fact probably accounts for the singular difficulty which Poléjaeff found in classifying the group, and appears to us to be a much more probable explanation of this difficulty than the assumption, for we can call it little else, that "*the whole group is nothing more than a simple family.*"[2] This method of cutting the Gordian knot, simple as it is, is hardly satisfactory.

Having come to the conclusion that the Monaxonida do not constitute a very natural order, although the two suborders therein included are probably natural enough, we ought perhaps to attempt some justification of our conduct in retaining the name at all. The real fault lay in the original distribution of the Challenger collections, and this could not be avoided, for it is only since this distribution was made, and since two of the Reports on Sponges have been published, while others have been far advanced, that the great mass of facts neccssitating the recent modifications in classification has been brought to light. At one time it was believed that the Monaxonida were a natural group, and by the time that the error was discovered the work was so far advanced that it was impossible to effect a redistribution. Hence we were left with two suborders, the Halichondrina and the Clavulina, and for these we have been forced to retain the name

[1] Marshall's Phoriospongiæ, which have given rise to so much discussion, are to be similarly explained as having originated polyphyletically from the Halichondrina. Marshall gives the following diagnosis of the genus:—"Kieselschwämme mit schlanken, einfachen Nadeln mit einer Spitze, Stecknadeln und Doppelhaken durchziehen und umspinnen Sandmassen, sie zu Klumpen vereinigend; das Ganze ist mit einer abziehbaren Haut bedeckt" (*Zeitschr. f. wiss. Zool.*, Bd. xxxv. pp. 122–126). The view proposed by him that they are siliceous sponges which penetrate and unite together masses of sand appears to us hardly to bear investigation; the fact that the whole mass is enclosed in a definite, pore-bearing, dermal membrane, as Marshall himself describes, is opposed to this idea. Von Lendenfeld (*Proc. Linn. Soc. N.S.W.*, vol. x. p. 81) advocates a very different hypothesis; he says "I do not hesitate to consider the Phoriospongiæ as belonging to the horny sponge as well as those Porifera which, like Dysidea, possess an arenaceous skeleton but no flesh-spicules. . . . . I consider the Phoriospongiæ not as boring sponges living in sand; but as Ceraospongiæ belonging to the group with arenaceous irregular fibres," and again (p. 84)—"I believe that the flesh-spicules in the Phoriospongiæ and horny sponges on the one hand, and those of the silicifibred sponges on the other have been produced independently of each other." It seems to us that von Lendenfeld also has here placed a wrong interpretation upon the facts before him. It is quite unnecessary to assign such a polyphyletic origin to the microsclera ("flesh-spicules") in question, and we regard the Phoriospongiæ not as forming a separate genus at all, but as derived from several distinct genera of Monaxonida, in which, probably owing to the influence of similar external conditions, the proper siliceous skeleton has been replaced to a greater or less extent by sand and other foreign bodies. The fact that when proper megasclera occur in these sand sponges they are small and slender, and to all appearance degraded forms, argues in favour of our view. It is well known that sponges have a strong tendency to take in foreign bodies of all kinds with which to build up a skeleton. In the horny sponges (*e.g.*, *Euspongia*, *Dysidea*) this very frequently occurs, and also in the Heterorrhaphidæ (*Tedania commixta*, nobis), the Desmacidonidæ (*Esperella parasitica*, Carter, *Esperella arenicola*, nobis, *Iophon omnivorus*, nobis), the Suberitidæ (*Polymastia agglutinans*, nobis), and the Spirastrellidæ (*Spirastrella solida*, nobis). In some cases these sand sponges have sufficient spicules remaining to enable us to say from what genus they have been derived, while in other cases this is no longer possible.

[2] Zool. Chall. Exp., part xxxi., Report on the Keratosa, p. 81.

Monaxonida, although we now feel that the group thereby designated has no place in a natural classification.

The Halichondrina are, taken as a whole, strongly contrasted with the Clavulina. Members of the former group very rarely indeed possess a true, fibrous cortex, while those of the latter are rarely without one. In the former group again the skeleton is usually more or less reticulate, in the latter group it is usually radiately disposed, with no secondary, crossing fibres. Thirdly, the Halichondrina have always, or nearly always, a greater or less amount of spongin in the skeleton, which is absent in the Clavulina. All these are important distinguishing characters which, taken in connection with the differences in spiculation, are quite sufficient to separate the two suborders.

Yet here, as in other cases, the line of division is not absolute, for we have, in the Axinellidæ, transitional forms. Hence we have placed the Axinellidæ next to the Suberitidæ and at the end of the Halichondrina. In the Axinellidæ the skeleton shows a strong tendency to radiate arrangement, and the spicules are generally monactinal, as in the Clavulina; moreover, the microsclera, when such are present, appear to be sometimes of a distinctly Clavulinid type; viz., stellate. As yet we know no Axinellid sponge with a true fibrous cortex, but, on the other hand, there are species referred to the genus *Suberites*, in which the presence of a fibrous cortex has not yet been demonstrated, although they possess the characteristic tylostylote spicules. The two genera *Suberites* and *Axinella* appear to be nearly related. This connection may be a less intimate one than we at present think, but this can only be decided when our now very imperfect knowledge of these sponges has been greatly augmented. This is the most apparent point of contact between the Halichondrina and the Clavulina, unless Schmidt's description of his *Sceptrella regalis*[1] should prove to be correct, and then we should be forced to imagine a connection between the Spirastrellidæ and the Esperellinæ. *Sceptrella regalis* is described as possessing discastra (spicules characteristic of the genus *Latrunculia*) and, at the same time, chelæ of a very peculiar type. It is placed by its founder amongst the Desmacidines. There is, presumably, only a single specimen of this sponge. It is described as "eine graue, dünne Kruste," and no account is given of the megasclera. Having regard to the extremely unlikely combination of discastra with chelæ, and to the fact that the sponge is known only by a thin crust, and bearing in mind also the frequent occurrence in sponges of spicules belonging to other species, we are strongly inclined to believe that Schmidt had before him a young Spirastrellid sponge growing over the remains of some species belonging to the Esperellinæ, and that the discastra belong to one sponge and the chelæ to the other.[2]

[1] Spong. Atlant. Gebiet., p. 58; *cf.* also p. 234 of the present work.

[2] This view of the case is very strongly supported by our examination of a preparation of the spicules of *Sceptrella regalis* (labelled in Schmidt's handwriting) in the British Museum. We find that the discastra and megasclera are typically those of a *Latrunculia*. The latter are smooth, sharp-pointed styli, agreeing with those of other species of *Latrunculia* even down to the characteristic slight crookedness of the shaft (*cf.* Pl. XLV. figs. 8, 9, 10), and measuring

The Halichondrina are divided by us into four families, the Homorrhaphidæ, the Heterorrhaphidæ, the Desmacidonidæ, and the Axinellidæ. To these von Lendenfeld adds a fifth family, the Spongillidæ,[1] but with the fresh-water sponges we have in this place nothing to do, and we cannot afford the time and space to discuss their systematic position.

The Homorrhaphidæ are, obviously, a fairly satisfactory group. All have a reticulate skeleton, all have diactinal megasclera, and all are without microsclera of any kind. The group includes two subfamilies, the Renierinæ and the Chalininæ, each of which has long been recognised, but hitherto these two subfamilies have been far too widely separated, and that merely on the ground that in the Chalininæ there is a greater development of spongin than in the Renierinæ. Nearly all Renierine sponges have more or less spongin in the skeleton, and, as a matter of fact, it is impossible to say where the Renierinæ end and the Chalininæ begin. The Chalininæ appear to be derived from Renierinæ (probably polyphyletically, *i.e.*, from several distinct genera), which, living in warm seas, have developed a horny skeleton more or less at the expense of the spicular element. The Chalininæ proper, as we have already noted, are simulated by genera belonging to quite distinct groups, which, living under similar conditions, have suffered a similar change in their skeletons. We have thus in the family Heterorrhaphidæ the two genera *Toxochalina* and *Gelliodes*, each with a distinct, well developed horny skeleton exactly similar to that of true Chalininæ, and also with diactinal megasclera, but each betraying its true position by the presence of microsclera. By some authors (*e.g.*, von Lendenfeld) the former genus is included amongst the Chalininæ, but we cannot agree to such an arrangement.[2] The mere possession of a horny skeleton is not sufficient guide to the systematic position of a sponge, and this fact cannot be too strongly enforced. The Chalininæ are very poorly represented in the Challenger collection, and this is accounted for by the fact that they are essentially shallow-water forms, and are rarely if ever met with in deep-sea dredgings. Moreover, their range is rather a restricted one. On the other hand, in the large collection of sponges obtained in Australian seas by Dr. R. von Lendenfeld, and now lodged in the British Museum, the species of Chalininæ are extremely plentiful and varied. Dr. von Lendenfeld's descriptions of these sponges are now in course of publication, and we hope that when they appear much will have been done towards putting the group on a more satisfactory footing with regard to classification.

about 0·44 by 0·011 mm. The chelæ, on the other hand, are characteristically those of the genus *Myxilla*. Many, or most of them, it is true, possess four teeth, but this condition is known to occur in at least one species of the latter genus (*Myxilla mariana*, nobis ; *cf.* p. 138, footnote). There are a fair number of them in the preparation, and they are all, or nearly all, equal ended and not, as stated by Schmidt, generally unequal ended. In short, Schmidt's figures and description of these spicules are misleading in the extreme ; there can scarcely be a doubt that they are present as foreign spicules, and such an occurrence is not at all uncommon.

[1] *Proc. Zool. Soc. Lond.*, December 21, 1886, p. 584.

[2] Mr. Carter carries this line of argument a step further, and actually includes a species of *Homœodictya*, characterised by its remarkable chelate microsclera, in the genus *Chalina*, presumably because of the amount of spongin present in the skeleton (*Ann. and Mag. Nat. Hist.*, ser. 5, vol. x. p. 111).

The Heterorrhaphidæ constitute, perhaps, the least natural of our four families. In many respects they occupy an intermediate position between the Homorrhaphidæ and the Desmacidonidæ. As their name implies, they are possessed of different kinds of spicules, as opposed to the Homorrhaphidæ, in which we never find more than one kind. Microsclera are present in the group, but these are never of the chelate type. The five subfamilies, viz., Phlœodictyinæ, Gelliinæ, Tedaniinæ, Desmacellinæ and Hamacanthinæ, into which the Heterorrhaphidæ are divided, are not so intimately related *inter se* as are either the two subfamilies of the Homorrhaphidæ or of the Desmacidonidæ.

The Phlœodictyinæ form a compact and very remarkable group. Both in external form and in anatomical characters they appear to be strongly contrasted with other subfamilies of the Heterorrhaphidæ. The first known specimen of the group was dredged by the Rev. A. M. Norman off the Shetland Islands in 1861. It was evidently only a fragment, and was named by Bowerbank *Isodictya robusta*.[1] In 1864 Mr. J. G. Jeffreys dredged another specimen, also off the Shetland Islands, which was much mutilated by the dredge, and was named by Bowerbank *Desmacidon jeffreysii*.[2] Later discoveries showed that these two fragments belonged to one and the same species, of which the Rev. A. M. Norman was the first to describe an entire specimen. He established the genus *Oceanapia* for this interesting form.[3]

In 1870 Schmidt founded his genus *Rhizochalina*,[4] the type species being *Rhizochalina oleracea*. Although in the present Report we keep these two genera distinct, yet we have very strong reasons for believing that they ought to be united, and then the genus *Oceanapia* would be the sole representative of the subfamily. Finally, in 1882, Carter established[5] his "Group" "*Phlœodictyina*," and included therein nine species, all partaking more or less of the characters of the original *Oceanapia robusta*. Unfortunately the material at our disposal is not in very good condition for anatomical investigation, but an examination of thin, stained sections has led us to believe that future researches, under more favourable circumstances, will lead to very interesting results.

Concerning the Gelliinæ we have very little to say. The subfamily is characterised by the extreme simplicity of the spiculation, which in the case of the genus *Gellius* is identical with that of the genus *Oceanapia*. This identity might be thought to indicate a close relationship between the two subfamilies. Possibly it does indicate some connection, but we do not think that this can be a very intimate one, for, although the Gelliinæ present us with great diversity in external form, yet we know no instances of anything like an approach to the highly characteristic form of the Phlœodictyinæ; in other words the sponge is never divisible into body and fistulæ, and this is a very important

[1] Mon. Brit. Spong., vol. ii. p. 304.
[2] Mon. Brit. Spong., vol. ii. p. 347.
[3] Brit. Assoc. Report for 1868, p. 334.
[4] Spong. Atlant. Gebiet., p. 35.
[5] *Ann. and. Mag. Nat. Hist.*, ser. 5, vol. x. p. 117.

distinction between the two. Moreover, the sigmata, which occur in both subfamilies, are such a common and wide spread type of microsclera that their presence cannot be safely relied upon in estimating probable relationships. From their extreme simplicity it appears quite possible that they may have originated independently in several groups.[1] We distinguish three genera in this subfamily, and we have already pointed out the interesting fact, that here, as in the Homorrhaphidæ, there is a very strong tendency towards the development of horny fibre, which asserts itself as soon as the necessary surroundings (viz., moderately warm and shallow seas) are attained.

The Tedaniinæ, which we have placed next in the series, are also a very isolated group. The spiculation is, so far as the megasclera are concerned, identical with that of the genus *Myxilla* amongst the Desmacidonidæ, even down to the relative positions of the two forms of spicules in the sponge. A very wide distinction lies, however, in the fact that the Tedaniinæ have no chelæ, but, in place thereof, simple rhaphides, which are unknown in the genus *Myxilla*. The differentiation of the megasclera into "main" and "dermal" forms, differing fundamently from one another in shape, must be considered as an indication of a high degree of specialisation and alone quite sufficient to necessitate the removal of the Tedaniinæ from amongst the Renierinæ, where they have been placed by previous authors. It seems not unlikely that here, as in the Phlœodictyinæ, the only two described genera will have to be merged into one; for the distinguishing character (*i.e.*, the spination of the styli in *Trachytedania*) can hardly be considered of generic importance (*cf.* the similar spination of the styli in some species of the genera *Iophon* and *Myxilla*).

The Desmacellinæ are not a very satisfactory subfamily, for as yet we know hardly anything about them. There is only a single established genus, viz., Schmidt's *Desmacella*, and they differ from the Gelliinæ only in the replacement of the diactinal megasclera by monactinal forms; it is very possible that these two subfamilies should be united, though we have found it convenient for the present to keep them distinct.

We come now to the last subfamily of the Heterorrhaphidæ, viz., the Hamacanthinæ. In this subfamily we meet with microsclera of a very remarkable and entirely unique form, the diancistra. These spicules seem to be peculiarly constant in shape in the different species. That they have some connection with the ordinary sigmata of other sponges is very probable, but they are always distinguished from these by the presence of a sharp, cutting inner edge with three notches, one in the centre of the shaft and one at each angle where the shaft bends round to form the terminal hooks. The nearest approach which we have found to this spicule in any other genus is the large sigma of *Esperella simonis* (Pl. XV. fig. 13), which differs, however, in the absence of the characters just mentioned, though resembling the diancistra in its unusually large size and in the shape

[1] *Cf.* Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., 1884, p. 371.

of the hooks. So far as we know certainly, the diancistra do not occur amongst the Desmacidonidæ. Schmidt, however, describes[1] a sponge under the name *Vomerula tibicen*, which is stated by him to contain "Doppelankern" and "Pflugscharspangen;" unfortunately there are no figures, and the entire description is comprised in the following words:—"*Vomerula tibicen.* Neu—Vom Habitus des Desmacidon tunicatum, also incrustirend, mit Oberhaut, welche in ½ bis 1 Cmtr. lange Röhren übergeht. Nach den Kieseltheilen wäre diese Art ein Desmacidon zu nennen, das ausser den characteristischen Körpern, nämlich den etwas gebogenen Nadeln, den Doppelankern van 0·0257 Mmtr., und den etwa halb so langen Spangen, auch noch die grossen Pflugscharspangen von 0·157 Mmtr. enthält.

"Es ist damit eine abermalige Combination und Uebergangsform verwirklicht. Ob wir es mit einer constanten Form oder mit einer individuellen Abschweifung von Vomerula zu Desmacidon oder umgekehrt zu thun haben, ist nicht zu entscheiden.—Fundort: Grenada, 170 Faden."

The combination of spicules here indicated would be so unusual were the "Pflugscharspangen" true diancistra, that we cannot help feeling some doubt on this point, and thinking that possibly they may be only large contort sigmata like those of *Esperella simonis*, nobis, and somewhat resembling the true diancistra; or, supposing that they are true diancistra, then perhaps the chelæ occur as foreign bodies, as in the analogous case of *Sceptrella regalis* (*vide supra*). Further information concerning this point is much needed; if diancistra are really present, and also chelæ, then the species in question forms a most important link between the subfamilies Hamacanthinæ and Esperellinæ; it would, of course, be referable to the latter.

The subfamily Hamacanthinæ is divided into two genera, according to whether the megasclera are diactinal (as in *Hamacantha*) or monactinal (as in *Vomerula*).

The Desmacidonidæ, constituting our third family, are characterised by the presence of chelate microsclera. These spicules are, unlike the sigmata, of such very complex and remarkable form that we cannot believe them to have originated polyphyletically, that is, independently in several groups. Hence we are constrained to class together in one family all those species which possess them, and this arrangement will, we hope, be found to be a satisfactory one. It is but a slight, though an important modification of the arrangement followed by previous authors. Thus, the Desmacidonidæ of Vosmaer include, on the one hand, more than our family, in that he admits most of our Heterorrhaphidæ, *i.e.*, species without chelæ, while, on the other hand, they include less, in that he keeps separate the Ectyoninæ, which do possess chelæ. This is an arrangement of which we cannot at all see the justification, more especially with regard to the separation of the "Ectyonidæ," and in the present work we consider the old "Ectyonidæ" as a subfamily of the Desmacidonidæ under the name Ectyoninæ. The presence in the Ectyoninæ of

[1] Spong. Meerb. von Mex. pt. ii. p. 83.

echinating spicules is, as we shall proceed to show, quite insufficient to justify such a wide distinction between the two groups as Vosmaer admits.

We divide the Desmacidonidæ into two subfamilies—(1) the Esperellinæ, in which the skeleton fibre is not echinated by projecting spicules, and (2) the Ectyoninæ, in which echinating spicules are present. These two subfamilies are, however, by no means sharply marked off from one another, for we actually have, in the genus *Myxilla* (placed by Vosmaer as well as by ourselves amongst the Desmacidonidæ), both species with and species without the echinating spicules, and these different species are so closely allied that we have found it impossible to separate them generically. This question is again referred to in the systematic portion of the work, under the genus *Myxilla*, to which we refer the reader for further details. Here then lies the justification, and we think it will prove to be a sufficient one, of the present arrangement.

It is probable, nay certain, that the first division of the family, the Esperellinæ, will require subdivision, and in our opinion it will fall into several very natural groups, but we cannot, in the present work, make such an arrangement, as we have not the necessary time at our disposal for a complete revision of the group.

The Ectyoninæ are a very difficult group to deal with; most of them are evidently sponges which are developing a strong horny skeleton at the expense of the spicular element, and the poor degree of development exhibited by the spicules makes their classification unusually difficult. Possibly, as held by Mr. Carter, they have some connection with the Axinellidæ, but we cannot believe that it is nearly so close a one as he seems to indicate in uniting the Ectyoninæ and Axinellidæ in one group by themselves, the "Echinonemata." To our minds their intimate connection with the Esperellinæ far outweighs in importance any relationship which may exist in the Axinellid direction, while the presence of a strongly developed horny skeleton is to be connected here, as in the Chalininæ, with the fact that they flourish almost exclusively in warm areas.

We consider the Axinellidæ as constituting a family by themselves, which we place at the end of the Halichondrina, and hence after the Ectyoninæ and near to the Suberitidæ, with which they seem to have striking affinities. These affinities have already been discussed in speaking of the relations of the Halichondrina to the Clavulina, so we shall not dwell upon them in this place. The family is a very difficult one to deal with, and our knowledge of it is in a most unsatisfactory condition. Its most striking positive character, and that in which it most nearly approaches the Ectyoninæ, is the arrangement of the spicules to form the skeleton-fibre; but though there is a strong superficial resemblance between the two groups in this respect, yet the arrangement is in reality very distinct in the two cases, for in the Axinellidæ *all* the spicules have their apices projecting very obliquely outwards and forwards from the centre of the fibre, while in the Ectyoninæ there is a central core of longitudinally placed spicules cemented together by horny

matter, the fibre thus constituted being echinated by *special* spicules which project from its surface more or less at right angles, or the spicular core may be absent, leaving only the horny fibre and the echinating spicules. Yet here again, we have at least one species, viz., *Myxilla frondosa*, nobis, which seems to indicate a transition between these two types of skeleton arrangement. In the universal absence of chelæ, however, the Axinellidæ are sharply defined from the Ectyoninæ and other Desmacidonidæ.

We come now to the second of our suborders, viz., the Clavulina. We have already indicated the probable relations of this group to the Halichondrina. The four most prominent features of the group (none of which, however, will probably be found to be quite constant throughout) are (1) the presence of radiately arranged tylostylote spicules; (2) the cork-like, granular ground substance; (3) the presence of a distinct fibrous cortex; and (4) the absence of spongin from the skeleton. As we have already hinted, we have no doubt whatever that this group is closely related, through the Tethyadæ, to the so-called Tetractinellida. We shall not further discuss this question, but refer the reader to Vosmaer's latest remarks on the subject.[1]

According to the presence or absence of microsclera we divide the Clavulina into two families; (1) Suberitidæ, in which there are no microsclera, and (2) Spirastrellidæ, in which microsclera are present. This appears to us to be a much more natural arrangement than that proposed by Dr. Vosmaer,[2] viz., according to the presence or absence of mammiform projections on the surface of the sponge.[3] This difference in ideas is perhaps partly accounted for by the fact that Vosmaer has omitted from his scheme the two very important genera *Spirastrella* and *Latrunculia*, both of which are well represented in the Challenger collection. The Clioniadæ, of which group the members, save that they appear to be mostly Clavulina, have only the boring habit in common, will have to be distributed chiefly between the Suberitidæ and Spirastrellidæ, as there is no reason at all for supposing that species of both these families (and of others also) may not have independently acquired the boring habit; and the spiculation of the different boring sponges seems to indicate that this is the case.

[1] Bronn's Klass. u. Ordnung. d. Thierreichs, Porifera, p. 474 (translated by Dendy, *Ann. and Mag. Nat. Hist.*, ser. 5, vol. xix. p. 249).

[2] Bronn's Klass. u. Ordnung. d. Thierrichs, Porifera, p. 328, *et seq.*

[3] Vosmaer also gives in the diagnosis (*loc. cit.*) of his Polymastidæ "Faserrinde meist sehr deutlich," and of his Suberitidæ "eine echte Faserrinde fehlt immer;" but, inasmuch as he includes the genera *Suberites* and *Stylocordyla* in his Suberitidæ, we must emphatically deny the correctness of the latter statement (*cf.* our own researches on the minute anatomy of these genera, *supra*, and Pl. L.).

DESCRIPTION OF GENERA AND SPECIES.

Order MONAXONIDA.

1878. *Monactinellidæ*, Zittel, Zur Stammegeschichte der Spongien,[1] p. 9.
1883. *Monaxonidæ*, Sollas, Cassell's Natural History, vol. vi. p. 326.

Siliceous sponges with uniaxial megasclera.

Suborder I. HALICHONDRINA.

1885. *Halichondrina*, Vosmaer, Bronn's Klass. u. Ordnung. d. Thierreichs, Porifera, p. 335.

Typically non-corticate; skeleton usually reticulate; megasclera usually either oxea or styli.

Family I. Homorrhaphidæ.[2]

1886. *Homorrhaphidæ*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 326.

Megasclera all diactinal, either oxea or strongyla; no microsclera.

Subfamily 1. Renierinæ.

1870. *Renierinæ, pars*, Schmidt, Spong. Atlant. Gebiet., p. 39.
1886. *Renierina*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 326.

The spicules may be united together by a small proportion of spongin, but are never completely enveloped in it.

Genus *Halichondria*, Fleming (Pls. I., II., XLVI.).

1828. *Halichondria*, Fleming, History of British Animals, p. 520.
1862. *Reniera, pars*, Schmidt, Spong. Adriat. Meeres, p. 72, &c.
1870. *Amorphina*, Schmidt, Spong. Atlant. Gebiet., p. 40.

Skeleton confused, may be fibrous but never regularly reticulate. Spicules oxea or strongyla, usually long and slender. Spongin scarcely appreciable.

[1] Festgabe der philosophischen Facultät zum 50 jährigen Doctorjubiläum des Professor von Siebold, München.
[2] From Gr. ὁμός, one and the same; and ῥαφίς, needle.

In the simple form and arrangement of the spicules this is the most primitive of all genera of siliceous sponges. It is characteristic of littoral regions in most or all parts of the world, but never seems to occur in deep water. Schmidt was the first to really restrict the genus within reasonable limits,[1] but Vosmaer[2] has shown that he was in error in overlooking the earlier name *Halichondria*.

The original type of the genus is the well known and cosmopolitan species *Halichondria panicea*.

Halichondria panicea, Johnston (Pl. II. figs. 2, 3).

1842. *Halichondria panicea*, Johnston,[3] British Sponges, p. 114, pl. x. and pl. xi., fig. 5.
1870. *Amorphina panicea*, Schmidt, Spong. Atlant. Gebiet., p. 77.
1881. *Amorphina megalorhaphis*, Carter, Ann. and Mag. Nat. Hist., ser. 5, vol. vii. p. 368.
1884. *Amorphina megalorrhaphis*, Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., p. 416.
1885. *Amorphina megalirrhaphis*, Ridley, Narr. Chall. Exp., vol. i. pt. ii. p. 571.

Vosmaer[4] has already given a good abstract of the history of this old and well-known species, to which we must refer the reader. A good description of the species is to be found in Johnston's British sponges (*loc. cit.*), and still further details are given by Bowerbank.[5]

Carter[6] has already described a specimen of *Halichondria panicea* (var.) from Kerguelen, which was obtained by the Transit of Venus expedition. Later (*loc. cit. sup.*) he describes his *Amorphina megalorhaphis*, from the Basse Rocks, Ceylon, and in so doing makes the following observations:—"This seems to be a variety of the common British species *Halichondria panicea*, chiefly differentiated by the size of its largest spicules, which is double that of the English one. The spicules also of the specimens brought home by the Rev. A. E. Eaton from Kerguelen's Island, and others dredged up by H.M.S. "Porcupine" in the Atlantic Ocean, are much larger than those of the common British species; so that this variation may extend even to our own shores, while the single form, great variety in size, and long attenuation towards the end of the spicule generally characterise the species everywhere."

We have now to record a series of specimens[7] from Kerguelen, which to our mind completely establish the identity of the British *Halichondria panicea* with Mr. Carter's *Amorphina megalorhaphis*.

While agreeing remarkably well in external form these specimens (of which there are seven or eight of fair size, in addition to smaller pieces) exhibit a great range in the

[1] *Amorphina, loc. cit.* [2] Bronn's Klass. u. Ordnung. d. Thierreichs, Porifera, p. 337.
[3] For probable synonyms of older writers, *vide* Johnston, *loc. cit.*
[4] Bronn's Klass. u. Ordnung. d. Thierreichs, Porifera, p. 336.
[5] Mon. Brit. Spong., vol. ii. p. 229. [6] *Phil. Trans. Roy. Soc.*, vol. clxviii. p. 286.
[7] One of these specimens was figured in the preliminary account, Narr. Chall. Exp., vol. i. pt. ii. p. 571, fig. 188.

size of the spicules. The following table shows the length of the largest spicules in various specimens.

1. A specimen from Ilfracombe, in the Bowerbank collection, Brit. Mus.; average maximum length about 0·35 mm.
2. Mr. Carter's specimen from Kerguelen; average maximum length about 0·5 mm.
3. One of the Challenger specimens from Kerguelen; average maximum length about 0·6 mm.
4. Another of the Challenger specimens from Kerguelen; average maximum length about 0·77 mm.
5. *Amorphina megalorhaphis* (as given by Carter, *loc. cit.*), "varying in length from 1–128th to 1–23rd inch" (=about from 0·2 to 1·0 mm.).

Under these circumstances we consider ourselves justified in including all the above mentioned specimens under the name "*Halichondria panicea.*"

Some of the Challenger specimens from Kerguelen are infested by a very abundant Oscillatorian Alga; especially one which is coloured of a dark chocolate brown, but whether the colour is due to the Alga or not is an open question; several sponges from Kerguelen were similarly coloured.

There is also a single small specimen, noteworthy on account of its dark coloration at and near the surface, from a pool at Oosima, Japan; this agrees in every essential respect with the common British form; the oscula are distinct and rather large, the dermal skeleton beautifully reticulate, and the spicules up to about 0·5 by 0·0126 mm. in size.

The species thus appears to be cosmopolitan.

Localities.—"Royal Sound, Kerguelen, 20–60 fathoms;" "Kerguelen, 10–100 fathoms;" "Christmas Harbour, Kerguelen, 60 fathoms;" Oosima, Japan, 14th March 1875, "Pool," one specimen.

Habitat.—British Seas (Johnston, Bowerbank, &c.); Basse Rocks, off south-east coast of Ceylon (Carter); Kerguelen (Carter, Challenger); Torres Strait (Ridley, "Alert"); Atlantic (Carter); Japan (Challenger).

Halichondria caduca, Bowerbank (Pl. II. fig. 15).

1866, &c. *Halichondria caduca*, Bowerbank, Mon. Brit. Spong., vol. ii. p. 234, and vol. iii. pl. xli. figs. 9–11.

We identify with this species a single small, cavernous specimen from off the south-west coast of Patagonia (Station uncertain). It agrees well with Bowerbank's species in external form, colour, rugged surface and probably also in its cavernous structure; also in the size and form of the spicules (Pl. II. fig. 15), which measure about 0·28 by 0·01 mm.

in both, and in the arrangement of the fibre, though this is rather more definite in the main skeleton in Bowerbank's sponge.

Locality.—Off the south-west coast of Patagonia. One specimen.

Habitat.—British seas (Bowerbank); off south-west coast of Patagonia (Challenger).

Halichondria solida, Ridley and Dendy (Pl. II. figs. 5, 5*a*).

1886. *Halichondria solida*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 326.

Sponge massive, sessile, encrusting, growing over a mass of nullipore. The single specimen in the collection is about 62 mm. long by 37 mm. broad and 31 mm. thick. *Colour* in spirit greyish-yellow.[1] *Texture* extremely compact; firm, but slightly compressible. *Surface* uneven, rather rough to the touch; may be minutely hispid in places. *Dermal membrane* difficult to make out, inseparable from the underlying tissues. *Oscula* doubtful; few if any; possibly the sponge is lipostomous.

Skeleton.—There is no special dermal reticulation distinguishable as such from the main skeleton. The main skeleton consists of a densely felted mass of long oxeote spicules, densely packed, but without order and without discernible fibres. Hence there is no great difference in appearance between a surface section and a section taken at right angles to the surface.

Spicules.—More or less curved, large, smooth, fusiform oxea (Pl. II. figs. 5, 5*a*), almost invariably rounded off instead of pointed at each end (thus becoming strongylote), and with the end often rather wrinkled or roughened in appearance. Size extremely variable, both as regards length and thickness. The largest spicules are by no means the thickest; length up to about 1·1 mm., thickness up to about 0·038 mm.; the degree of curvature also varies very much.

This species may be distinguished by its very dense and compact structure, the absence of any skeleton fibres, and the rounding off of the ends of the spicules. If it were not for the absence of a definite skeletal fibre, it would be rather referable to *Petrosia*, especially considering the tendency of its spicules to become blunted (*cf. Petrosia truncata, infra*).

Locality.—Reefs, Tahiti; September 28, 1875; depth, 30 to 70 fathoms. One specimen.

Halichondria solida, var. *rugosa*.

We propose the above name for a single, large, massive, sub-columnar, sub-lobose specimen of a dark chocolate-brown colour. It differs from the type of the species (1) in its dark colour; (2) in the nature of the surface, which is roughened by little

[1] Tinged with violet owing to the presence of a darkly-coloured horny sponge on the same mass.

prominences resembling miniature chains of peaked mountains, over and between which it is glabrous; (3) in having the skeleton less compact (this does not affect the tough, compact character of the sponge, which in this case is not dependent on the skeleton arrangement); (4) in having the ends of the spicules more commonly pointed, but still roughened and irregular and very different from the long drawn out, sharply and evenly pointed ends in *Halichondria panicea*.

The specimen in question is 106 mm. in height by about 37 mm. in average diameter. It bears several distinct, circular oscula, about 3 mm. in diameter.

Locality.—Off Api, New Hebrides, 60 to 70 fathoms. One specimen.

Halichondria pelliculata, Ridley and Dendy (Pl. I. figs. 1, 1*a*; Pl. II. fig. 9).

1886. *Halichondria pelliculata*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 326.

The single specimen in the collection (Pl. I. figs. 1, 1*a*) is erect, lobose, increasing gradually in width from below upwards, and marked by a series of transverse grooves and swellings into a number of segments, each of which probably represents a stage in the growth of the sponge; the top is flattened, and the sponge is just beginning to branch into two lobes. In the middle of the flattened top there is a large compound osculum, and a similar one occupies the end of the incipient branch (Pl. I. fig. 1, *o*, *o*). The height of the specimen is 62 mm., and the diameter at the top not quite 25 mm. *Colour* in spirit yellow. *Texture*, internally soft and friable, but the surface is hard and chitinous. *Surface* corrugated as above described, but smooth and glabrous. A thin, hard, chitinous membrane covers the entire surface of the sponge, and appears to take the place of the dermal membrane. Whether this is only a post-mortem condition or not, we are unable to say. Just below the surface are great numbers of round or oval, highly granular bodies, about 0·3 mm. in diameter; these may be the gland-cells which secrete the chitinous envelope;[1] they occur in less numbers in the deeper parts of the sponge. *Oscula* (Pl. I. fig. 1, *o*, *o*); at the summit of the sponge is a single large round opening, about 6 mm. in diameter, subdivided by a number of vertical partitions which separate the different exhalent canals from one another; a similar, but smaller osculum occurs at the top of the incipient branch.

Skeleton.—(*a*) *Dermal;* a very abundant reticulation of irregularly scattered, horizontally placed, large oxeote spicules. (*b*) *Main;* so far as we have been able to ascertain this is rather sparse, not very regular, and with few distinct fibres, being composed of large scattered oxeote spicules. It is, however, very difficult to obtain a satisfactory vertical section, owing to the fragility of the internal tissues. In parts at any rate the skeleton is rectangular in its arrangement, the fibres containing few spicules.

[1] For this very probable suggestion we are indebted to Dr. R. von Lendenfeld.

Spicules.—Large, stout, fusiform oxea (Pl. II. fig. 9), curved, and gradually and fairly sharply pointed; size about 0·45 by 0·028 mm.

This species is at once distinguishable from all others of the genus by its external form and its characteristic chitinous envelope (hence the specific name). The size and shape of the spicules are also very characteristic. In the presence of an external chitinous membrane it resembles *Rhizochalina fistulosa*. Like the preceding species, it has a great general resemblance to *Petrosia*, but, on the other hand, the skeleton arrangement shows some approach to the rectangular character of *Reniera;* but as the dermis is subreticulate, and the spicule is a large tapering oxeote, it seemed best to regard it as a decidedly aberrant member of the genus *Halichondria*.

Locality.—Amboina; depth, 100 fathoms. One specimen.

Halichondria latrunculioides, Ridley and Dendy (Pl. I. figs. 5, 5*a*; Pl. II. fig. 1; Pl. XLVI. fig. 5).

1886. *Halichondria latrunculioides*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 326.

Sponge erect, lobose; two out of the three specimens collected are pear-shaped, and have apparently been attached by the narrow end to the substratum on which they grew. The third specimen, which is the largest, is lobose and compressed in a vertical plane; it has a much constricted base, by which it has evidently been attached. The largest specimen measures 44 mm. in height, by 72 mm. in greatest breadth, and about 12 mm. in average thickness; the larger of the two pear-shaped specimens measures 50 mm. in height by 27 mm. in diameter near the top. *Colour* in spirit light grey. *Texture* rather soft and spongy internally. *Surface* uneven, deeply corrugated, but glabrous; with numerous large, round or oval, flat, sieve-like pore-areas, elevated above the general surface of the sponge, and constituting by far the most important character of the species (Pl. I. fig. 5, *p.a.*, and fig. 5*a*). *Dermal membrane* forming (except in the pore-areas), together with its supporting layer of spicules, a thickish, parchment-like crust, readily separable from the underlying tissues. In the pore-areas, on the other hand, the dermal membrane is very thin, delicate, and transparent, and reduced to a mere sieve by the very numerous pores. *Oscula* at the summits of conical projections of the parchment-like dermal membrane at the top of the sponge (Pl. I. fig. 5, *o*). *Pores* almost entirely confined to the pore-areas (Pl. I. fig. 5*a*); we have, however, detected a few in gaps in the almost continuous dermal skeleton.

Skeleton.—(*a*) *Dermal;* a very dense, in most parts perfectly continuous layer of large oxeote spicules laid horizontally side by side (Pl. XLVI. fig. 5). (*b*) *Main;* loose, composed of rather irregularly arranged spiculo-fibre; the fibre itself is often fairly stout, but not very definite or compact.

Spicules.—Large, straight, or very slightly curved, fusiform oxea (Pl. II. fig. 1), sharply and usually gradually pointed. Size commonly about 0·7 by 0·022 mm., but often much larger, measuring about 1·25 by 0·031 mm. In these larger spicules one end is usually markedly larger than the other, and the points are irregular.

This is a very interesting species, and forms another example of the extraordinary diversity and richness of the sponge-fauna at Station 320. We have called the species "*latrunculioides*," owing to the curious resemblance which it bears in external form to species of the genus *Latrunculia*, of which two were obtained from the same Station.

As we have already had occasion to remark, the most noteworthy character of the species is the arrangement of the pores in definite, raised pore-areas. We at first thought that this feature would prove of generic importance, but concluded finally that it is not so, being apparently only a case of adaptation, which, however, at once separates the species from all others of the genus. The arrangement of the pores is, as usual, closely correlated with the arrangement of the dermal skeleton. The dermal skeleton in this sponge is so closely packed together that there is literally no space left for the pores (*vide* Pl. XLVI. fig. 5), hence these are almost entirely confined to special areas set apart on purpose for them (Pl. I. figs. 5, 5*a*). It is very interesting to notice how precisely the same adaptation in the arrangement of the pores has taken place in a totally different and widely separated sponge, viz., *Latrunculia apicalis* (*vide infra*); here also the dermal skeleton, although of quite a different kind, is so dense as to allow no room for the pores, which are confined to special raised areas. It is further interesting to notice how these two sponges consequently resemble one another in external form, and that both were obtained from the same station.

Locality.—Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; off the mouth of the Rio de la Plata; depth, 600 fathoms; bottom, green sand; bottom temperature, 37°·2. Three specimens.

Halichondria sp. (*a*).

Under this head we must mention two amorphous masses of sponge, apparently belonging to the genus *Halichondria*, each encrusting a delicately branched white Gorgonia from Station 320. The specimens do not present sufficient characters to make a specific determination desirable. They are very soft, spongy, and cavernous, and the skeleton is confused and lax in the extreme. Spicules, smooth, slightly curved oxea, rather abruptly pointed at each end; size, very fairly constant, about 0·35 by 0·017 mm.

Locality.—Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; off the mouth of the Rio de la Plata; depth, 600 fathoms; bottom, green sand; bottom temperature, 37°·2. Two specimens.

Halichondria sp. (*b*).

We include under this head two fragmentary, massive, amorphous specimens and a few small pieces from off Marion Island, all in a very bad state of preservation, to which we are not prepared to assign any specific name. They are certainly not worthy of the erection of a new species for their reception, and we know of no old one in which they might be included. They are characterised chiefly by a coarse, brittle, dermal layer, readily shaling off, composed of the dermal membrane and a more or less close reticulation of oxeote spicules supporting it. Texture brittle, cavernous. Main skeleton, an irregular loose reticulation of oxeote spicules. Spicules, smooth, slightly curved oxea, rather abruptly pointed; size, about 0·42 by 0·017 mm.

Locality.—Off Marion Island, December 26, 1873; depth, 50 to 75 fathoms. Fragments.

Halichondria (?) sp. (*c*), (Pl. II. fig. 4).

Sponge apparently free, lobose. The single specimen consists of three short, stout lobes, united together at their bases. All the lobes are hollow and rather thin-walled, the large central cavities all communicating with one another.[1]

The specimen is 37 mm. in greatest diameter (from apex to apex of two lobes), and about 12 mm. thick in the middle. *Colour* in spirit pale greyish-yellow. *Texture* rather brittle. *Surface* uneven, but smooth and slightly glabrous, with a minutely reticulate appearance. *Dermal membrane* delicate and transparent, but with a chitinous look. *Oscula* (?); there are several small round apertures which lead right through from the exterior to the internal cavities, and one which seems to communicate only with a canal system within the thickness of the wall.

Skeleton.—(*a*) *Dermal;* an irregular but very abundant reticulation of closely packed, long oxeote spicules. (*b*) *Main;* very dense, composed of closely packed, long oxea, not very regular, but stout fibres may be distinguished running towards the surface, and others crossing them; separate spicules again are irregularly strewn throughout, so that the whole thickness of the sponge-wall consists of little else but spicules.

Spicules.—Very long, curved (often slightly crooked), fusiform oxea (Pl. II. fig. 4), gradually and finely pointed. Size variable, measuring up to about 0·87 by 0·022 mm.

Considering that there is only a single specimen of this sponge, which may be abnormal or injured, we have thought it better to describe it without creating a new

[1] In the blind end of one of the lobes were found two small Crustaceans, but it is hardly likely that these can have caused the very extensive excavation of the interior, though the possibility of their being concerned in it must be borne in mind.

species for its reception. In spiculation it comes very close to *Halichondria panicea*, while its general form suggests *Rhizochalina*.

Locality.—Station 203, October 31, 1874; lat. 11° 6′ N., long. 123° 9′ E.; Philippine Islands; depth, 12 to 20 fathoms; bottom, mud. One specimen.

Genus *Petrosia*, Vosmaer (Pls. II., III.).

1862. *Reniera* (?), Schmidt, Spong. Adriat. Meer., p. 76.
1863. *Schmidtia*, Balsamo-Crivelli, Atti Soc. Ital. Sci. Nat., vol. v. p. 293.
1864. *Thalysias, pars*, Duchassaing and Michelotti, Spongiaires de la mer Caraïbe, &c.
1885. *Petrosia*, Vosmaer, Bronn's Klass. u. Ordnung. d. Thierreichs, Porifera, p. 338.

Sponge usually hard or even stony; generally with numerous, well-defined, large oscula. Skeleton more or less confused; spicules oxeote to strongylote, usually short and thick, packed close together in tracts.

The most obvious feature of this genus is its hard, often stony texture. Vosmaer has changed the older name *Schmidtia* into *Petrosia*, because the former was found to be already occupied.

Petrosia similis, Ridley and Dendy (Pl. II. fig. 10; Pl. III. figs. 3, 4).

1879. *Thalysias subtriangularis*, Carter, Phil. Trans., vol. clxviii. p. 287.
1886. *Petrosia similis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 327.

Sponge (Pl. III. figs. 3, 4) variable in external form, repent, branching; branches sometimes anastomosing, subangular or cylindrical, with large circular oscula arranged in series on the upper surface; or erect and lobate with large circular oscula at the summits of the lobes. We have here two very distinct types of external form in the same species. The repent specimens (Pl. III. fig. 3) are very much broken; the best measures 93 mm. in length by about 12 mm. in diameter, and bears nine large circular oscula arranged in a single row along its upper surface. There is only one lobate specimen (Pl. III. fig. 4), which in external form bears some resemblance to *Clathria elegantula*, nobis (*cf.* Pl. XXVIII. fig. 3), and measures 81 mm. in height by 87 in width. *Colour* in spirit yellowish-grey. *Texture* (of the lobate specimen) firm and almost incompressible, fibrous; (of the repent specimens) much more yielding to the touch, easily compressible, fibrous but brittle. *Surface* smooth but uneven and harsh to the touch; often with a reticulate appearance owing to the reticulations of the skeleton fibre, which show through the dermal membrane. *Dermal membrane* distinct, translucent, firmly adherent to the underlying tissues. *Oscula* large, circular, numerous; sometimes more than 6 mm. in diameter, like great circular pits in the surface. *Pores*, round openings in the dermal membrane, very few seen.

Skeleton.—There is no special dermal skeleton, but spicules project in irregular, sparse tufts from the uppermost portion of the main skeleton, and serve to support the dermal membrane, commonly projecting slightly beyond it; these tufts are nothing but the projecting ends of the primary skeleton fibres. The main skeleton (in the lobate specimen) is a very well-developed reticulation of very stout, compact spiculo-fibre, in which there is a well-marked distinction between primary and secondary fibres crossing one another at right angles and running vertically to, and parallel with, the surface of the sponge. The rectangular meshes between the fibres vary much in size, usually they are large. In the repent specimens, the skeleton is not so well developed, being laxer and more confused.

Spicules.—Slightly curved oxea (Pl. II. fig. 10), fairly sharply and fairly gradually pointed, size about 0·225 by 0·016 mm.

The above description is taken from a series of specimens, all from Station 142, which must be considered as the types. There is also in the collection a single small piece from Station 150, without oscula and probably young, which we identify with the species; it differs from the types in having a very compact skeleton with very indistinct fibre, and in having the spicules rather larger, measuring about 0·3 by 0·016 mm.

The specimen obtained from Kerguelen by the Transit of Venus Expedition, and described by Mr. Carter (*loc. cit. supra*), must also, having regard to the locality and measurements of the spicules, be referred to this species rather than to *Thalysias subtriangularis*. Here again the skeleton reticulation is closer, but the fibre not so well developed as in the types of *Petrosia similis;* the spicules average about 0·19 by 0·0126 mm. in size.

The synonymy of the different species of *Petrosia* is very difficult to unravel. Undoubtedly this species comes near to *Thalysias subtriangularis*, Duchassaing[1]; the difficulty is to find out exactly what that species is. Even supposing that Schmidt had not examined Duchassaing's type specimens, yet, having regard to the localities, it is probable that his identification of his *Schmidtia aulopora*[2] with Duchassaing's *Thalysias subtriangularis* is correct. *Thalysias repens*, Carter,[3] also from the West Indies, which Mr. Carter calls "a repent form of the white species *subtriangularis*, viz., *Thalysias repens*, mihi," appears from the measurement of his figure of the spicule (which is thus shown to be about 0·18 mm. long.) to be the same species as Schmidt's *aulopora*. In *Schmidtia aulopora*, Schmidt, the spicules measure about 0·175 by 0·0078 mm., being thus shorter and not half so thick as in the types of *Petrosia similis*.[4]

[1] Animaux radiaires des Antilles, p. 26. See also Duchassaing and Michelotti, Spongiaires de la mer Caraïbe, Haarlem, 1864, p. 85, pl. xvii. fig. 1, pl. xviii. fig. 1.

[2] Spong. Atlant. Gebiet., 1870, p. 44, Taf. v. fig. 8.

[3] *Ann. and Mag. Nat. Hist.*, April 1882, p. 282, pl. xi. fig. 10.

[4] The measurements of the spicules in *Schmidtia aulopora* are taken from a preparation in the British Museum, labelled in Schmidt's handwriting, from St. Thomas.

No doubt the Kerguelen specimen forms a connecting link, but we think it advisable to distinguish between two closely allied species, *Petrosia subtriangularis* and *Petrosia similis*, the former characteristic of West Indian seas, and the latter of the seas south of the Cape. Two well-marked varieties of the latter are described below, one of which occurs as far north as the Philippine Islands.

Localities.—Station 142, December 18, 1873; lat. 35° 4′ S., long. 18° 37′ E.; south of the Cape of Good Hope; detph, 150 fathoms; bottom, green sand; bottom temperature, 47°·0. Several specimens.

Station 150, February 2, 1874; lat. 52° 4′ S., long. 71° 22′ E.; between Kerguelen and Heard Island; depth, 150 fathoms; bottom, coarse gravel; bottom temperature, 35°·2. One small piece.

Habitat.—South of the Cape of Good Hope (Challenger); Kerguelen (Carter); between Kerguelen and Heard Island (Challenger).

Petrosia similis, var. *massa* (Pl. II. fig. 11; Pl. III. fig. 6).

Sponge (Pl. III. fig. 6) massively lobose, or consisting of very stout cylindrical branches. The largest specimen is a flattened lobose mass, which, judging from the fact that it bears oscula on both surfaces, has probably grown erect; it is 162 mm. high by about 50 in average breadth (narrowing from above downwards) and 18 mm. thick. *Colour* in spirit greyish-yellow. *Texture* rather soft and spongy. *Surface* smooth but uneven. *Dermal membrane* distinct, in parts with a lace-like reticulate appearance owing to the supporting skeleton reticulation. *Oscula* large, circular; irregularly scattered over the surface (yet with some tendency to form series); about 4 mm. in diameter; commonly surrounded by a slightly prominent rim. *Pores*, rounded openings in the dermal membrane as usual.

This variety differs from the types in its more slender spicules, in the looser skeleton arrangement and less compact and well-developed fibres (hence its soft, spongy character), and in the more irregular arrangement of the oscula. The spicules (Pl. II. fig. 11) measure up to about 0·28 by 0·012 mm. The dermal membrane is not supported on projecting tufts of spicules, but rests directly upon a reticulation of spiculo-fibre, which is, however, only the uppermost layer of the main skeleton. The character of the dermal skeleton in th different species of *Petrosia* seems to be of very little use in separating them.

Locality.—Station 314, January 21, 1876; lat. 51° 35′ S., long. 65° 39′ W.; between the Strait of Magellan and the Falkland Islands; depth, 70 fathoms; bottom, sand; bottom temperature, 46°·0. Several specimens.

Petrosia similis, var. *compacta* (Pl. II. fig. 13; Pl. III. fig. 5).

Sponge (Pl. III. fig. 5) cylindrical, ramose, erect (?), or repent (?). The single specimen in the collection consists of a stout, irregularly cylindrical basal (?) portion, which bifurcates at one extremity into two but slightly divergent, more slender branches, about equal in length to the original piece. Total length 143 mm. Diameter of unbranched portion about 18 mm., and of branches about 10 mm. *Colour* in spirit light brownish-yellow. *Texture* stony hard but brittle. *Surface* uneven, smooth in appearance, but harsh to the touch. *Dermal membrane* rather coarse, translucent, allowing the subjacent skeleton reticulation to show through. *Oscula* large, conspicuous, circular, with their margins level (or almost so) with the general surface of the sponge, diameter about 4 mm. *Pores* scattered through the dermal membrane.

Skeleton.—The main skeleton is a very dense and compact, but rather irregular reticulation of spiculo-fibre and spicules, in which primary fibres are readily distinguishable, running vertically to the surface. Seen from the surface, the uppermost layer appears as a reticulation of stout spiculo-fibre with rounded meshes about 0·35 mm. in diameter, on which the dermal membrane rests directly.

Spicules.—Short, rather stout, slightly curved, fairly gradually and fairly sharply pointed oxea (Pl. II. fig. 13), measuring about 0·22 by 0·0145 mm.

This sponge is not unlike *Schmidtia variabilis*, var., from the same station, in external form, but may at once be distinguished by the much smaller spicules and denser texture. It is distinguished from the type of the species by its much more compact structure, and by the absence of the tufts of spicules supporting the dermal membrane, but agrees well in the size of the spicules. In its stony texture it resembles *Petrosia dura*, Nardo, but differs from typical specimens of that species in its external form, which is ramose, instead of tuberous or tuberously ramose. The skeleton-fibre also is by no means so compact and well developed, and the meshes of the main skeleton are much smaller. The spicules, again, are smaller, and do not exhibit that remarkable variability in size which characterises those of *Petrosia dura*.[1]

Locality.—Station 208, January 17, 1875; lat. 11° 37′ N., long. 123° 31′ E.; Philippine Islands; depth, 18 fathoms; bottom, blue mud. One specimen.

Petrosia truncata, Ridley and Dendy (Pl. II. fig. 14; Pl. III. fig. 1).

1886. *Petrosia truncata*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 327.

Sponge (Pl. III. fig. 1) massive, sessile. The single specimen in the collection is unfortunately only a fragment. It consists of a massive basal portion about 25 mm.

[1] Our knowledge of *Petrosia dura*, enabling us to make the above comparisons, is derived chiefly from specimens in the British Museum, obtained from Professor Schmidt. For descriptions of the species, *vide* Nardo, *Isis*, 1833, p. 522; Schmidt, Spong. Adriat. Meeres, p. 76, Taf. vii. fig. 13; Balsamo-Crivelli, *Atti Soc. Ital. Sci. Nat.*, vol. v. p. 293, Taf. v^{a}. figs. 1, 2, 3.

square and 18 mm. thick, from the upper surface of which arises abruptly a single, stout, thick-walled oscular tube with a large circular osculum at the summit. Height of oscular tube about 25 mm., diameter 14 mm., thickness of wall 4 mm. *Colour* in spirit greyish-yellow. *Texture* hard and stony, but rather brittle; internally rather cavernous. *Surface* smooth but uneven, and harsh to the touch. *Dermal membrane* distinct, but firmly adherent to the underlying tissues, translucent, very granular, frequently reduced to a mere network by the enormous number of pores. *Oscula*, one only present, a little over 4 mm. in diameter, at the summit of a large tubular projection. *Pores*, very numerous rounded openings about 0·07 mm. in diameter.

Skeleton.—There is nothing that can be properly termed a distinct dermal skeleton, but the dermal membrane is supported by a reticulation of stout spiculo-fibre, which is not to be distinguished from the main skeleton. The main skeleton consists of a reticulation of very well developed, stout spiculo-fibre in which one distinguishes primary fibres running vertically to the surface and secondary ones crossing them more or less at right angles. This distinction into primary and secondary fibres is not so evident in the deeper parts of the sponge as near the surface, the skeleton arrangement becoming here a more or less confused reticulation of stout spiculo-fibre. The fibre is compact, and averages about 0·1 mm thick.

Spicules.—Short, stout, smooth, slightly curved strongyla (Pl. II. fig. 14), evenly rounded off at each end, size about 0·17 by 0·0094 mm.

This species comes near to *Schmidtia aulopora*, but is distinguished from that species by the strongylote instead of oxeote spicules, by the stouter skeleton fibre, and possibly also by the arrangement of the oscula. If it should prove that the oscula in our species are always situated on the ends of prominent oscular tubes, this would be a very important character. This *Petrosia* approaches the most closely of all the Challenger species to that named *Reniera crateriformis* by Mr. Carter, characterised by a cup- or bowl-shaped form and sausage-shaped spicules.

Locality.—Station 208, January 17, 1875; lat. 11° 37′ N., long. 123° 31′ E.; Philippine Islands; depth, 18 fathoms; bottom, blue mud. One piece.

Petrosia variabilis, Ridley, sp., var. (Pl. II. fig. 12).

1884. *Schmidtia variabilis*, Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., p. 415, pl. xxxix. fig. N, pl. xli. fig. *t*.

With this species we identify as a variety a single specimen from the Philippine Islands. It is irregularly lobate in form, and, though hard in texture, is very brittle and cavernous; the surface is uneven and harsh to the touch, and has also a minutely reticulate appearance. This variety differs from the types of the species in its pale greyish-

yellow colour,[1] and in having slightly larger and decidedly stouter oxeote spciules (Pl. II. fig. 12), which measure about 0·45 by 0·022 as against 0·4 by 0·019 mm. There do not, however, appear to us to be sufficient differences to merit a distinct varietal name.

Locality.—Station 208, January 17, 1875; lat. 11° 37′ N., long. 123° 31′ E.; Philippine Islands; depth, 18 fathoms; bottom, blue mud. One specimen.

Habitat.—Port Darwin, North Australia (Ridley, "Alert"); Philippine Islands (Challenger).

Petrosia hispida, Ridley and Dendy (Pl. II. fig. 16; Pl. III. fig. 2).

1886. *Petrosia hispida*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 327.

Sponge (Pl. III. fig. 2) massive, sessile, subglobular or lobate, narrowing towards the base, bearing on the upper surface numerous small mammiform processes, each with a single round osculum at the summit. The larger of the two specimens measures 62 mm. in height by the same in breadth. *Colour* in spirit yellowish-grey. *Texture* firm and fairly compact, rather brittle. *Surface* uneven, minutely hispid. *Dermal membrane* difficult to make out, owing to the hispidity of the surface and the absence of a special dermal skeleton reticulation. *Oscula* very conspicuous, numerous small round openings, each on the summit of a volcano-like projection, remarkably constant in size, diameter about 1·5 mm. *Pores*, rounded openings scattered through the dermal membrane.

Skeleton.—No dermal reticulation. The main skeleton consists of a reticulation of spiculo-fibre, the primary lines being fairly distinct (sometimes five or six spicules broad), and running vertically to the surface, near which they are more distinct than elsewhere, and having their terminal spicules projecting for a short distance beyond the surface, thus causing the characteristic minute hispidity. The secondary lines are very confused and almost obliterated by numerous scattered spicules.

Spicules.—Smooth, slightly curved oxea (Pl. II. fig. 16), not very sharply but rather gradually pointed; size about 0·37 by 0·021 mm.

This species is distinguished by its beautiful and very characteristic external form and by its hispid surface; the spicules are rather large for the genus.

Locality.—Royal Sound, Kerguelen, January 17, 1874; depth, 25 fathoms. Two specimens.

Genus *Reniera*, Nardo (Pls. I., II.).

1847. *Reniera*, Nardo, Prospetto della fauna marina volgare del veneto estuario, Venice.
1864. *Isodictya, pars*, Bowerbank, Mon. Brit. Spong., vol. i. p. 197, &c.

Skeleton composed of definite, rectangular (sometimes triangular or polygonal), typically unispicular meshes. Spicules short oxea or strongyla, usually united together at the ends only by spongin.

[1] Perhaps due to a different mode of preservation.

This genus was first defined within its present limits by Schmidt.[1] Here, as in the case of other Renierinæ, it is impossible to give an absolute diagnosis separating it from other genera, but no one who has studied the group will fail to recognise the fact that it is a very natural genus. By the development of more spongin uniting the spicules this genus appears to have given rise to those Chalinine sponges which possess a definite rectangular skeleton, the fibre of which is cored by few and small oxeote spicules, *e.g.*, *Chalina* (*s. str.*).

We cannot agree with Schmidt in referring those species which have a separable dermal membrane ("zusammenhängende Oberhaut") to a distinct genus, *Pellina*, as we do not regard this character as being of generic importance. His original type of *Pellina* is *Reniera semitubulosa*, Schmidt. The so-called dermal membrane is also a very distinct feature of *Halichondria panicea*, yet Schmidt keeps this species out of his genus *Pellina*, into which it ought certainly to fall according to his definition, if such it can be called.[2]

Reniera cinerea, Grant, sp.

1827. *Spongia cinerea*, Grant, Edin. New Phil. Journ., vol. ii. p. 204.
1828. *Halichondria cinerea*, Fleming, History of British Animals, Edinburgh, p. 521.
1866. *Isodictya cinerea*, Bowerbank, Mon. Brit. Spong., vol. ii. p. 274 (*vide* also vol. iii. pl. xlviii.).

We identify with this species a single small, massive specimen from Station 209, measuring only about 12 mm. in diameter, and of a pale yellow colour. The spicules measure about 0·14 by 0·008 mm. In connection with this specimen the remarkably high temperature (71°·0) of the water in which it lived is very noteworthy.

Locality.—Station 209, January 22, 1875; lat. 10° 14′ N., long. 123° 54′ E.; Philippine Islands; depth, 95 fathoms; bottom, blue mud; bottom temperature, 71°·0. One specimen.

Habitat.—British Seas (Grant, Bowerbank, &c.); Philippine Islands (Challenger).

Reniera implexa, Schmidt, var. (Pl. I. fig. 4).

1868. *Reniera implexa*, Schmidt, Spong. d. Küste v. Algier, p. 27.

This species is well represented in the collection by a series of specimens from the Azores. These, though identical in external form (Pl. I. fig. 4) with Schmidt's species, as shown by comparison with specimens in the British Museum from Trieste, purchased from Professor Schmidt, differ slightly from it in skeletal characters. Thus the oxeote spicules are a little longer and more slender in the Challenger variety, measuring about 0·16 by 0·0063 mm. as against about 0·138 by 0·007 mm. This difference is but very

[1] Spong. Atlant. Gebiet., p. 39.

[2] Spong. Atlant. Gebiet., p. 41.

slight; a more noteworthy one lies in the arrangement of the spicules, for in our variety the primary fibres are well marked off from the secondary ones, and contain more than one row of spicules, usually about two or three. We cannot, therefore, say of our sponge, as Schmidt does of his types of the species, "Die doppelspitzigen Nadeln bilden das charakteristische einreihige Netzwerk der ächten Renieren." There is not, however, by any means sufficient difference to justify the erection of a new species. As no one has ever figured this interesting form, we take the present opportunity of doing so; no one besides Schmidt seems hitherto to have met with it.

Locality.—Station 75, July 2, 1873; lat. 38° 38′ N., long. 28° 28′ 30″ W.; off the Azores; depth, 450 fathoms; bottom, volcanic mud. About a dozen specimens.

Habitat.—Adriatic Sea (Schmidt); off the Azores (Challenger).

Reniera aquæductus, Schmidt, var. *infundibularis*, nov. (Pl. I. fig. 2; Pl. II. fig. 8).

1862. *Reniera aquæductus*, Schmidt, Spong. Adriat. Meeres, p. 73, pl. vii. figs. 6, 6*a*, 6*b*.
1884. *Reniera* sp., Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., p. 410.

Sponge (Pl. I. fig. 2) consisting of a thin lamella, folded so as to form irregular funnels and tubes which may anastomose. The largest specimen is a complex, hollow, thin-walled mass growing together with a Gorgonia; the shape of the whole is very irregular, and its greatest length is about 100 mm. The wall of the sponge is only about 2 mm. thick. *Colour* in spirit pale yellow. *Texture* very delicate, spongy and fragile. *Surface* uneven but smooth. *Dermal membrane* very thin and transparent, allowing the round or oval subdermal cavities to show through, and thus giving to the surface a beautiful reticulate appearance.

Skeleton.—Typically Renierid in arrangement, *i.e.*, forming a rectangular, unispicular reticulation.

Spicules.—Small, smooth, very slightly curved oxea (Pl. II. fig. 8), rather slender and sharply pointed at each end; size about 0·17 by 0·008 mm.

This variety differs from the types of the species mainly in external form; forming funnel-shaped or only irregularly tubular masses instead of regular cylindrical tubes.

The name *infundibularis* was suggested by Ridley[1] in 1884 for some fragments of a *Reniera* obtained by the "Alert" in Torres Strait, which may probably be included under this species, and which also differ from the types in not forming definite symmetrical tubes; this sponge agrees so closely in spiculation and external form (though, from the fact that fragments only were obtained, we cannot say certainly that it was infundibular) with the Challenger variety, that it seems desirable to include both under the same name.

[1] Zool. Coll. H.M.S. "Alert," Brit. Mus., p. 411, 1884.

Locality.—Station 307, January 4, 1876 ; lat. 49° 24′ 30″ S., long. 74° 23′ 30″ W.; off the south-west coast of Patagonia; depth, 140 fathoms; bottom, blue mud. One specimen.

Off the south-west coast of Patagonia (Station uncertain). Two or three specimens.

Habitat.—Adriatic Sea (Schmidt); Port Darwin, Australia (Ridley, "Alert"); Torres Strait (Ridley, "Alert"); off the south-west coast of Patagonia (Challenger).

Reniera subglobosa, Ridley and Dendy (Pl. I. figs. 3, 3*a*; Pl. II. fig. 6).

1886. *Reniera subglobosa*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 327.

Sponge (Pl. I. fig. 3) sessile, subglobular, hollow, thick-walled, with a wide, circular, cloacal opening at the summit. Height 31 mm.; diameter about 25 mm.; diameter of cloacal opening 12 mm.; thickness of wall 8 mm. *Colour* in spirit yellowish-grey. *Texture* firm but very brittle; cavernous, traversed by canals which end beneath the dermal membrane on the outside of the hollow cup, their terminations being here irregularly dispersed. On the inside of the cup (Pl. I. fig. 3*a*) the openings of the canals (? oscula) are arranged in regular series, separated from one another by ridges as in the figure; these ridges, or strands of tissue, form a rectangular lattice-work. *Surface* even, and probably smooth in the living sponge. *Dermal membrane* delicate, transparent; largely rubbed off; where it still remains it extends right over the openings of the wide canals on the outer surface of the sponge; sometimes also it appears to extend over the inner openings; the oscula were very likely confined to the inside of the cup as in other flabellate and infundibuliform sponges. *Pores* found in the dermal membrane on the outside of the cup in the form of numerous, irregularly scattered, small, rounded openings variable in size, probably confined to the outside of the cup.

Skeleton.—The main skeleton consists of a confused but subrectangular reticulation composed of very loose spiculo-fibre, two or three spicules in width. There is also a definite unispicular dermal reticulation supporting the dermal membrane.

Spicules.—Smooth, slightly curved, subhastately and sharply-pointed oxea (Pl. II. fig. 6), measuring about 0·3 by 0·013 mm.

This species may be recognised by its fine, subglobular, hollow form; by the striking serial arrangement of the openings on the inner surface, and by its firm though brittle consistence. These characters, combined with the size of the spicules, are sufficient to distinguish it from all previously known species. Of possibly related species, *Reniera compacta*, Schmidt,[1] differs from *Reniera subglobosa* in its slender and longer spicules, and from *Reniera dura* in its bast-like cortex and spicules, which are twice as broad as here; they resemble it in their density of structure, but are possibly referable to *Petrosia*.

[1] Spong. Adriat. Meer., Supp. i. p. 38.

Locality.—Station 307, January 4, 1876; lat. 49° 24′ 30″ S., long. 74° 23′ 30″ W.; off the south-west coast of Patagonia; depth, 140 fathoms; bottom, blue mud. One specimen.

Reniera tufa,[1] Ridley and Dendy (Pl. I. figs. 6, 6*a*; Pl. II. fig. 7).

1886. *Reniera tufa,* Ridley and Dendy, Ann. and Mag. Nat. Hist., ser 5, vol. xviii. p. 328.

Sponge (Pl. I. fig. 6) massive, sessile, cake-like; represented in the collection by two pieces, each measuring about 62 mm. long by 43 broad, and up to 20 mm. thick. *Colour* in spirit greyish-yellow. *Texture* firm, almost stony, but somewhat brittle, the sponge being traversed by wide canals (*vide* Pl. I. fig. 6*a*). *Surface* smooth where the dermal membrane is intact, but uneven. *Dermal membrane* distinct, rather coarse, readily peeling off, strengthened by a close reticulation of spicules. *Oscula* rather small, circular, with their margins flush with the general surface of the sponge, and each surrounded by a membranous diaphragm which greatly reduces the diameter of the exhalent canals at the surface. *Pores,* as usual, rounded openings scattered through the dermal membrane.

Skeleton.—A compact, but rather irregular, almost unispicular reticulation of oxeote spicules, with triangular meshes; no special dermal skeleton.

Spicules.—Smooth, very slightly curved, subhastately-pointed oxea (Pl. II. fig. 7), measuring about 0·2 by 0·01 mm.

This species seems to come near to Schmidt's *Cribrochalina cretacea,*[2] but differs in the size of the spicules and in the arrangement of the oscula, the latter point being the most remarkable character in Schmidt's species.

Keller's *Reniera litoralis*[3] also resembles our species very strikingly, especially in external form; but here again we find differences in the arrangement of the oscula and the proportions of the spicules. In *Reniera litoralis* the spicules of the main skeleton are described as being nearly twice the length of those of the dermal skeleton and much more slender, a feature which does not obtain in *Reniera tufa.*

Locality.—Porto Praya, St. Iago, Cape Verdes, 100 to 128 fathoms. Two pieces.

Subfamily 2. Chalininæ.

1868. *Chalineæ,* Schmidt, Spong. d. Küste v. Algier, p. 7.
1886. *Chalinina,* Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 328.

A considerable amount of spongin is present, typically forming a thick sheath completely enveloping the spicules and uniting them into strong fibres.

[1] So-called from the resemblance to a piece of pumice-stone.
[2] Spong. Atlant. Gebiet., p. 36. [3] *Zeitschr. f. wiss. Zool.,* Bd. xxx. p. 579.

Genus *Pachychalina*, Schmidt (Pls. IV., V., VI., XLVI.).

1868. *Pachychalina*, Schmidt, Spong. d. Küste v. Algier, p. 8.
1886. *Dasychalina*, *p.p.* Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 329.

Lobose or digitate, solid. Fibres stout, with spicules numerous and arranged polyserially.

Schmidt's original diagnosis (*loc. cit. supra*) runs "Fasern aus vielen Reihen von Nadeln gebildet, welche durch Hornsubstanz fest verbunden sind." This diagnosis is not nearly exclusive enough and would include most species of Chalininæ. Two years later (in 1870) Schmidt describes the genus thus: "Nicht röhrige, knollige oder dickästige Chalineen mit dichtem festerem Faserwerk, das in den jüngeren Theilen nur eine oder wenige Nadelreihen, in den älteren und dichteren deren viele enthält. Die Fasern werden von innen nach aussen zu feiner, gehn nicht in Pinsel aus, sondern bilden ein zarteres Oberflächennetz, von welchem die Faserenden wie ein feiner Sammet abstehn. Zahlreiche Oscula erscheinen oft regelmässig in Reihen geordnet, oft ohne Ordnung gestellt und liegen entweder flach oder erheben sich mit kurzen Schornsteinen. Alle diese Merkmale und die Dichtigkeit des Gewebes variiren aber in dem Grade und zeigen in den von einander entfernteren Theilen eines und desselben Stockes solche Abstufungen, dass ich mir darauf hin nicht auf constante Species zu schliessen getraue." [1]

As an example of the genus he here cites *Spongia rubens*, Duch. et Mich. However difficult Professor Schmidt may have found it to distinguish between different species, and indeed it would appear from the passage here quoted that he abandons the attempt, we ourselves have found it no easy matter to make anything of the genus. Thinking that it would be both practicable and convenient to distinguish between two distinct groups of solid Chalinine sponges with stout fibres and many, polyserially arranged spicules, viz. (1) those with a smooth surface, and (2) those in which the surface is rugged and spinose, we have, in our preliminary report, proposed the name *Dasychalina* for the latter, and retained the name *Pachychalina* for the former. This we did under the impression that *Spongia rubens* was the first example mentioned of Schmidt's *Pachychalina;* we now find that this is not the case, but that the type of the genus is *Pachychalina rustica*, Schmidt, which is described as follows:—"Die Gattungsdiagnose ist von Exemplaren entlehnt, von denen das eine drei centimeter hoch, papillenförmig, mit etwas verdicktem oberen Ende und ganz unregelmässiger, fein krausiger Oberfläche, das andere länglich Kegelförmig, struppig ist. Die spitz-spitzen geraden oder etwas gebogenen Nadeln sind, 0·16 bis 0·175 Mmtr. lang." [2]

Unfortunately, then, this species, the type of the genus, may have a spinose (struppig) surface, and so our *Dasychalina* falls to the ground. It might be possible

[1] Spong. Atlant. Gebiet., p. 37. [2] Spong. d. Küste v. Algier, p. 8.

to make a genus for the other group of species, viz., those with smooth surface, but experience has shown that it will be advisable to leave this question to some naturalist who has more opportunity for studying a large series of forms. Hence we include both groups under the name *Pachychalina*.

Pachychalina fragilis, Ridley and Dendy (Pl. IV. figs. 2, 2*a*).

1886. *Dasychalina fragilis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 330.

Sponge (Pl. IV. figs. 2, 2*a*) irregularly ramose, subcylindrical, aculeated; branches averaging about 18 mm. in diameter. *Colour* in spirit light greyish- or brownish-yellow. *Texture* hard and brittle. *Surface* very uneven, covered with sharp aculeations; delicately striate, with the striæ radiating from the summits of the aculeations.[1] *Oscula* large and scattered, but almost entirely confined to one side of each branch; about 4 mm. in diameter.

Skeleton.—(*a*) *Dermal;* an irregular reticulation of individual spicules and spiculo-fibre, backed up behind by a much coarser reticulation of much stouter spiculo-fibre, the nodes of which form the apices of the surface aculeations. (*b*) *Main;* an irregular reticulation of very stout, compact spiculo-fibre and abundantly scattered spicules; the fibres are about 0·35 mm. thick, and the main fibres terminate on the surface at the summits of the aculeations. There is no doubt a good deal of spongin present uniting the spicules, but it is difficult to make out, and does not form a distinct sheath around the fibres as in typical Chalininæ. The fibre resembles that of *Petrosia*.

Spicules.—Oxea, very large for a Chalinine sponge; rather stout, slightly curved, suddenly and more or less bluntly pointed; size about 0·42 by 0·02 mm.

Taken by itself this species might have been described as a *Petrosia*, characterised by the aculeations on the surface, but it forms the first of a series of allied forms which seem to lead up from the Renierinæ to more typical species of *Pachychalina* and *Spinosella*.

Locality.—Station 208, January 17, 1875; lat. 11° 37′ N., long. 123° 31′ E.; Philippine Islands; depth, 18 fathoms; bottom, blue mud. Several large pieces.

Pachychalina melior, Ridley and Dendy (Pl. IV. fig. 1).

1886. *Dasychalina melior*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 330.

Sponge (Pl. IV. fig. 1) irregularly branched; branches subcylindrical or angular, coarsely aculeated; aculeations less abundant and well marked than in *Pachychalina fragilis*. Average diameter of branches about 12 mm. *Colour* in spirit greyish- or brownish-yellow. *Texture* compressible, fibrous, but rather hard. *Surface* uneven,

[1] In one small specimen only this striation of the surface is not visible.

subglabrous, with a faintly reticulate appearance, due to the subdermal cavities showing through the dermal membrane. *Dermal membrane* distinct, thin, transparent, perforated by numerous scattered pores. *Oscula* rather small and shallow; chiefly on one side of each branch; diameter little over 2 mm.

Skeleton.—(*a*) *Dermal;* a close, small-meshed reticulation of rather loose spiculo-fibre, echinated at the nodes by small bundles of outwardly projecting spicules, which are, at any rate in part, the projecting ends of the primary fibres. (*b*) *Main;* a rather irregular reticulation of spiculo-fibre and scattered spicules, in which primary and secondary fibres are distinguishable but not very well marked. Fibre much slenderer than in *Pachychalina fragilis*, but still without a very evident external sheath of spongin as in typical Chalininæ.

Spicules.—Rather slender, slightly curved, gradually and usually sharply pointed oxea; size about 0·175 by 0·0126 mm.

This species, though very distinct from both, forms a connecting link between *Pachychalina fragilis* and *Pachychalina fibrosa*, which is next described, and which has much slenderer spicules, and a greater amount of spongin in the fibre.

Locality.—Station 208, January 17, 1875; lat. 11° 37′ N., long. 123° 31′ E.; Philippine Islands; depth, 18 fathoms; bottom, blue mud. Two specimens.

Pachychalina fibrosa, Ridley and Dendy (Pl. IV. figs. 3, 4).

1886. *Dasychalina fibrosa*, Ridley and Dendy, Ann. and Mag. Nat. Hist, ser. 5, vol. xviii. p. 330.

Sponge (Pl. IV. fig. 3) erect or repent; branched. Branches stout, irregular, coarsely aculeated; bearing large circular oscula, usually on one side only. Diameter of branches ranging from about 6 to 25 mm. Length of spines varying greatly in different specimens, up to about 4 mm. *Colour* in spirit greyish-yellow. *Texture* coarsely fibrous, compressible and elastic. *Surface* coarsely aculeated, reticulate. *Dermal membrane* distinct, thin, translucent. *Oscula* large, circular, shallow (*i.e.*, the exhalent canals terminate at the bottoms of shallow depressions, *vide* figs. 3, 4).

Skeleton.—(*a*) *Dermal;* a very coarse reticulation of stout spiculo-fibre with usually triangular meshes, broken up by a much finer and rather irregular reticulation of very slender spiculo-fibre. The coarse fibre contains a very great number of spicules, and comparatively little spongin; measuring about 0·1 mm. in total thickness. The finer fibre is very slender, contains a larger proportion of spongin, and usually only a single row of spicules; thickness about 0·015 mm. (*b*) *Main;* a reticulation of very stout, branching and anastomosing spiculo-fibre; measuring up to about 0·14 mm. thick, and almost or quite filled with densely packed spicules. Spicules occur also very abundantly outside the fibre; irregularly scattered through the choanosome.

Spicules.—Small, slender oxea, very slightly curved; abruptly and often bluntly pointed; size about 0·1 by 0·0032 mm.

This species differs from *Pachychalina* (*Cladochalina*) *diffusa*, Ridley,[1] in the inferior amount of spongin in the fibre, in the slenderer spicules (0·0032 as against 0·0063 mm. thick) and in the much larger oscula.

Localities.—"Off Bahia, 7–20 fathoms"; several pieces. "Off Bahia" (inside label); "off Bermuda, shallow water" (outside label); several pieces.

Station 208, January 17, 1875; lat. 11° 37′ N., long. 123° 31′ E.; Philippine Islands; depth, 18 fathoms; bottom, blue mud. One small specimen (Pl. IV. fig. 4) of a variety, differing slightly in external appearance, but agreeing closely in microscopical structure, size of spicules, &c.

Pachychalina lobata, Ridley (Pl. V. fig. 1; Pl. XLVI. fig. 4).

1884. *Pachychalina lobata*, Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., p. 404.

The Challenger obtained one specimen of this sponge (Pl. V. fig. 1), which, being in much better condition than the single specimen obtained by the "Alert," and described by Ridley (*loc. cit.*), enables us to add some interesting details. The specimen in question consists of a single, long, compressed, digitate process; it has apparently grown erect and measures 200 mm. in length, 16 mm. in breadth, and a little over 8 mm. in thickness. There is an almost uniserial row of circular oscula down each margin (*vide* fig. 1), each osculum being about 2 mm. in diameter. The dermal membrane is delicate and transparent, supported by a very beautiful and regular reticulation of spiculo-fibre. The pores are very numerous, reducing the dermal membrane in the meshes of the dermal reticulation to a mere network (Pl. XLVI. fig. 4).

This specimen differs from the type of the species; (1) in the size of the spicules, which measure only about 0·16 by 0·0115 mm. as against 0·21 by 0·0128 mm.; (2) in the possession of a more highly developed and regular dermal skeleton reticulation. That there is a similar dermal reticulation in the original type we have convinced ourselves by a re-examination of the specimen, but it is not so well developed as in the Challenger sponge; and thus the original description is incorrect in so far as it is stated that the dermal skeleton is "a closely-set coat of subparallel spiculo-fibres."

The specific name *lobata* was given by Ridley on the supposition that the species was identical with Esper's *Spongia lobata*,[2] but we have now arrived at the conclusion that this identification is untenable; hence the "Alert" specimen must stand as the type of *Pachychalina lobata*.

Locality.—Port Jackson; 30 to 35 fathoms. One specimen.

Habitat.—Port Darwin, Australia (Ridley, "Alert"); Port Jackson, Australia (Challenger).

[1] Ann. and Mag. Nat. Hist., ser. 5, vol. xiv. p. 183.

[2] Die Pflanzenthiere, vol. ii. p. 273, pl. xlvi.

Pachychalina megalorrhaphis, Ridley and Dendy (Pl. V. fig. 6).

1886. *Pachychalina megalorrhaphis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 328.

Sponge (Pl. V. fig. 6) composed of rather slender, long, cylindrical branches, which may anastomose. Maximum diameter of branches in the single specimen nearly 12 mm., but average diameter much less. *Colour* in spirit pale yellow. *Texture* compressible and elastic. *Surface* almost quite smooth, very minutely hispid. *Dermal membrane* thin, transparent, allowing the subdermal cavities to appear through it, and give to the surface a faintly mottled or reticulate appearance. *Oscula* rather small, subuniserially arranged along the branches.

Skeleton.—(*a*) *Dermal;* not very distinct. A small-meshed reticulation of loose spiculo-fibre, echinated at the nodes by small tufts of projecting spicules which are the ends of the primary fibres. (*b*) *Main;* a subrectangular reticulation of spiculo-fibre and single spicules, with very distinct primary lines running vertically to the surface. The skeleton fibre is fairly strong and polyspiculous, but with no distinct sheath of spongin surrounding it. The main lines are five or six spicules broad.

Spicules.—Slightly curved, gradually sharp-pointed oxea; size about 0·245 by 0·016 mm.

The spicules of this species are large for a Chalinine sponge, and the amount of spongin is correspondingly small, but the elastic, fibrous texture, the external form, and the arrangement of the skeleton leave no doubt as to its systematic position.

Locality.—Station 163D, June 12, 1874; lat. 33° 57′ 30″ S., long. 151° 39′ 15″ E.; off the coast of New South Wales; depth, 120 fathoms; bottom, green sand. One specimen.

Pachychalina elongata, Ridley and Dendy (Pl. VI. fig. 1).

1886. *Pachychalina elongata*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 329.

Sponge (Pl. VI. fig. 1) digitate, ramose; branches very long, varying in diameter in different parts of their length, up to about 12 mm., which is, however, unusually wide, the average being about 8 mm. Greatest length about 300 mm. Branches sometimes anastomosing. *Colour* (?) (now dark reddish-brown, but this is probably due to packing in a metal case). *Texture* very compressible, elastic, tough and fibrous. *Surface* smooth, subglabrous. The dermal membrane, together with its supporting skeleton reticulation, forms a very tough, distinct skin, but very firmly adherent to the deeper portion of the sponge which it encloses. *Oscula* small, scattered, chiefly on one side of the sponge.

Skeleton.—(*a*) *Dermal;* a close-meshed reticulation of stout, compact, spiculo-fibre, echinated by projecting spicules; meshes small, only about 0·11 mm. wide. (*b*) *Main;* a rectangularly meshed reticulation of spiculo-fibre, very well developed, with a great

deal of spongin; fibre about 0·07 mm. thick, polyspiculous, spicules not confined to the centre of the fibre.

Spicules.—Slightly curved oxea, fairly sharply and gradually pointed; size about 0·1 mm. by 0·0065 mm.

Locality.—Station 162, April 2, 1874; lat. 39° 10′ 30″ S., long. 146° 37′ 0″ E.; Bass Strait; depth, 38 fathoms; bottom, sand and shells. One specimen.

Pachychalina (?) punctata, Ridley and Dendy (Pl. VI. figs. 2, 2*a*, 2*b*, 2*c*; Pl. XLVI. figs. 1, 2).

1886. *Pachychalina (?) punctata*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 329.

Sponge (Pl. VI. fig. 2) erect, flattened, lobose. The single specimen in the collection consists of a large flattened lobe, bearing near the summit two smaller ones. The large lobe may itself have been formed by the coalescence of smaller ones, as there are two large holes right through it. Height of sponge 143 mm.; breadth 87 mm.; thickness about 6 mm. *Colour* in spirit rather dark greyish-yellow. *Texture* very tough and leathery, compressible and elastic. *Surface* very uneven but glabrous. *Oscula* (Pl. VI. figs. 2, 2*b*, *o*), small round openings, scattered at about equal distances from one another on one side only of the sponge; diameter about 1 mm. *Pores* (?) (Pl. VI. figs. 2, 2*a*, 2*b*, *p*, 2*c*, *p*, and Pl. XLVI. fig. 1) unusually large; visible to the naked eye as minute openings scattered singly but very abundantly on both sides of the sponge (Pl. VI. figs. 2, 2*a*); diameter up to about 0·35 mm., but varying, and usually smaller. They appear to be lined by spongin (?), which projects into their cavities in large bosses, frequently arranged so that the cavity has the form of a cross, the four angles between the arms being filled up by four projections of spongin (?) (Pl. XLVI. fig. 1). Possibly this arrangement is to guard against the ingress of noxious parasites, &c.[1]

Skeleton.—(*a*) *Dermal;* a very well-developed, close-meshed reticulation of spiculo-fibre (Pl. XLVI. fig. 1), with plenty of spongin, and echinated abundantly by projecting spicules. Meshes only about 0·07 mm. wide. (*b*) *Main;* also very well developed, with strong primary fibres, about 0·07 mm. thick, radiating to the surface, and crossed by secondary fibres in a lattice-like manner (Pl. XLVI. fig. 2). Fibres polyspiculous, but with a thick sheath of spongin. Also numerous scattered spicules between the fibres.

Spicules.—Slightly curved, sharply and rather gradually pointed oxea; size about 0·09 by 0·0055 mm.

The species is very well characterised, the most characteristic and interesting point being the special means adopted for guarding the inhalent apertures (if such they be). The amount of spongin present in the sponge is very large, whence its tough and leathery

[1] Probably pores also occur as small openings through the thin dermal membrane, but we are not certain about this point.

consistence. It is important to observe that though the oscula are confined to one surface of the frond, the pores occur on both.

Locality.—Station 162, April 2, 1874; lat. 39° 10′ 30″ S., long. 146° 37′ 0″ E.; Bass Strait; depth, 38 fathoms; bottom, sand and shells. One specimen.

Pachychalina (*?*) *pedunculata*, Ridley and Dendy (Pl. V. fig. 5).

1886. *Pachychalina* (*?*) *pedunculata*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 329.

Sponge (Pl. V. fig. 5) erect, stipitate, cylindrical; tapering to a blunt point above, and with a short, rather stout stem attached to a worm tube. Total height about 127 mm., diameter of body a little over 18 mm.; of stalk 6 mm. *Colour* in spirit greyish-yellow. *Texture* very soft and spongy, fairly elastic. *Surface* even, very minutely hispid; readily fraying out into tags. *Dermal membrane* very thin and delicate. *Oscula* rather small, scattered.

Skeleton.—Composed of loose fibres and scattered spicules, the main fibres only distinct, running vertically to the surface. No special dermal skeleton. Fibres very loose, main about six spicules broad. Only a small amount of spongin present.

Spicules.—Rather slender, slightly curved, gradually and sharply pointed oxea; size about 0·5 by 0·017 mm.

This species resembles in several respects Vosmaer's *Pachychalina caulifera*,[1] but it is cylindrical instead of flattened, and the shape of the spicules is different, being slender instead of broadly fusiform. The fibres in *Pachychalina caulifera* appear to contain a good deal more spongin than in the present species; indeed, it is only doubtfully that we include the latter in the genus at all; it forms another connecting link between the Renierinae and Chalininae, and shows how little value can be placed upon the amount of spongin present for purposes of classification.

Locality.—Kerguelen Island, 10 to 100 fathoms. One specimen.

Genus *Chalina*, Grant (Pls. V., XLVI.).

1861. *Chalina*, Grant, Tabular View of the Animal Kingdom, p. 76.

Form various, not tubular, surface smooth. Skeleton reticulation rectangular, with much spongin and few spicules; fibres typically slender, with a single axial series of spicules.

Concerning the name *Chalina*, we quote as follows from the "Alert" Report:—"This genus was merely mentioned by name in Grant's Tabular View of the Animal Kingdom

[1] Report on the Sponges dredged up in the Arctic Sea by the "Willem Barents," in the years 1878 and 1879, p. 33, pl. i. fig. 14; pl. iii. figs. 64–66.

(1861). In 1864 Dr. Bowerbank[1] (first) defined the genus correctly, assigning to it *Spongia oculata*, Pallas, as its type species. Schmidt therefore appears to me to be in the wrong when he (Spong. Atlant. Gebiet., p. 32) removes this species to his genus *Chalinula*, of 1868, and restricts *Chalina* to species which have the habitus of Euspongia and Cacospongia." [2]

We have now come to the conclusion that the characters of the genus *Chalina* should be made to depend rather upon the structure and arrangement of the fibre than upon any mere growth form. Thus we should now include in the genus recent species, such as *Chalina rectangularis*, nobis, which would formerly have come under the genus *Acervochalina*, and forms like *Chalina pergamentacea*, Ridley, which have hitherto been assigned to *Cladochalina*.

Chalina palmata, Lamarck, sp. (Pl. V. fig. 4).

1813. *Spongia palmata*, Lamarck, Ann. Mus. Hist. Nat. Paris, vol. xx. p. 453.

Sponge (Pl. V. fig. 4) of erect habit; much branched, palmo-digitate; branches compressed. The single specimen in the collection measures 68 mm. in height by 100 in breadth. *Colour* in spirit pale yellow. *Texture* soft and spongy, tough and fibrous. *Surface* fairly even, very slightly hispid; with a reticulate appearance due to the underlying structures appearing through the thin, transparent dermal membrane. The *dermal membrane* itself has also a very minutely reticulate appearance due to the dermal skeleton fibres. *Oscula* small, round, irregularly scattered, averaging a little over 1 mm. in diameter. *Pores*, rounded openings, varying considerably in size, scattered very profusely through the dermal membrane.

Skeleton.—(*a*) *Dermal;* a triangularly and polygonally-meshed reticulation of very thin spiculo-fibre. The fibre contains a very large proportion of horny matter, and has a core of slender oxeote spicules uni- or biserially arranged; the fibre is also "armed" with oxeote spicules stuck through it more or less at right angles. (*b*) *Main;* composed of a rectangularly-meshed reticulation of stouter fibre, containing a very large amount of horny matter, but with a core of slender oxeote spicules arranged in the primary fibres polyserially (not strictly parallel but in a somewhat plumose manner), but in the secondary, crossing fibres, usually only uni- or biserially.

Spicules.—Small, usually slightly curved oxea, measuring about 0·077 by 0·0024 mm.

The most characteristic features of this species are its external form and the arrangement of the dermal skeleton.

We have satisfied ourselves fairly well, by examination of Lamarck's probable type in the Jardin des Plantes, that ours is the same species, but as it has never been thoroughly described, we give a full description. Lamarck's *Spongia palmata* is not to be confused

[1] Mon. Brit. Spong., vol. i. p. 208.

[2] Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., 1884, p. 393; *Cf.* also Vosmaer, Bronn's Klass. u. Ordnung. des Thierreichs, Porifera, pp. 211, 341.

with the *Spongia palmata* referred to by Johnston;[1] the latter seems to be a *Homœodictya*.[2]

Locality.—Station 186, September 8, 1874; lat. 10° 30′ S., long. 142° 18′ E.; Torres Strait; depth, 8 fathoms; bottom, coral mud.

Habitat.—Indian and European Seas (Lamarck); seas of New Holland ("var. β") (Lamarck); Torres Strait (Challenger)

Chalina pergamentacea, Ridley (Pl. V. fig. 2).

1881. *Cladochalina armigera*, var. *pergamentacea*, Ridley, Proc. Zool. Soc. Lond., January, 1881, p. 112, pl. x. fig. 4.
1884. *Cladochalina pergamentacea*, Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., p. 398.

Represented in the collection by a single small, compressedly lobate specimen (Pl. V. fig. 2) bearing a row of circular oscula of various sizes all round the margin. The specimen is characterised by a very glabrous surface (very likely the surface of the type would have been glabrous had it not been dried). The fibre is not so stout as in the type, and the spicules are very much more abundant, and in the larger fibres arranged polyserially. As the external form of this sponge is very characteristic, and has never yet been figured, we give an illustration of it.

Locality.—Station 162, April 2, 1874; lat. 39° 10′ 30″ S., long. 146° 37′ 0″ E.; Bass Strait; bottom, sand and shells. One specimen.

Habitat.—Off the east coast of Brazil (Ridley, "Alert"); Torres Strait (Ridley, "Alert"); Bass Strait (Challenger).

Chalina rectangularis, Ridley and Dendy (Pl. V. fig. 3; Pl. XLVI. fig. 6).

1886. *Chalina rectangularis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 331.

Sponge (Pl. V. fig. 3) sessile, encrusting, thin; throwing up here and there low, mound-like prominences, each of which normally bears a single osculum at the summit. The single specimen covers half a valve of a *Pecten*-shell; the crust is only slightly over 2 mm. in average thickness, except where the mound-like projections are situated; these rise to a height of about 4 mm. above the general surface. *Colour* in spirit pale yellow. *Texture* rather compact, but compressible and elastic; tough and fibrous. *Surface* subglabrous, microscopically granulated. *Dermal membrane* thin and transparent; firmly adherent to the underlying tissues. *Oscula* rather small; at the summits of projections. *Pores*, abundant, small, rounded openings through the dermal membrane; averaging only about 0·04 to 0·05 mm. in diameter, but varying rather in this respect.

Skeleton.—(*a*) *Dermal;* a very definite, polygonally-meshed reticulation of spiculo-

[1] British Sponges, p. 92.

[2] See below under the subgenus *Homœodictya*.

fibre. The fibre contains but little horny matter, is usually polyspiculous, and is abundantly echinated, especially at the angles of the meshes, by tufts of outwardly projecting spicules. The meshes are small, averaging only about 0·14 mm. in diameter. (*b*) *Main;* a very regular, well-developed, rectangularly-meshed reticulation of strong spiculo-fibre; the primary lines running vertically to the surface, and the secondary ones crossing them at right angles (Pl. XLVI. fig. 6). The fibre is polyspiculous (the primary lines containing more spicules than the secondary), but though the spicules form a large proportion of its bulk, there is a great amount of horny matter present which completely envelops them; thickness of fibre up to about 0·06 mm.

Spicules.—Short, stout, slightly curved, sharply but very abruptly pointed oxea; size about 0·088 by 0·009 mm.

The external appearance, the form and size of the spicules, and the great regularity of the rectangular skeleton, are characters by which this sponge may be recognised. Indeed, it is an unusually well-marked species. It differs from most Chalinine sponges in the comparatively small proportion of horny matter in the spiculo-fibre, and is the only known strictly encrusting species of the subfamily, although in their low crouching growth, as well as in the skeleton arrangement and size of the spicules, *Chalina finitima* of Schmidt and *Chalina limbata* of Bowerbank make an approach to it.

Locality.—Station 208, January 17, 1875; lat. 11° 37′ N., long. 123° 31′ E.; Philippine Islands; depth, 18 fathoms; bottom, blue mud. One specimen.

Chalina sp. (*a*).

A small fragment composed of short, cylindrical branches, about 4 mm. in diameter, which we have been able to refer to no species known to us, and which is too imperfect to render a recognisable specific description possible. It is characterised by a beautifully reticulate surface, the fibres of the reticulation, as seen by the naked eye, standing out as delicate raised veins, the meshes being triangular. On microscopical examination, the meshes of this coarser reticulation are seen to be subdivided by much finer fibres into a number of very small secondary meshes. The coarser fibres of the dermal reticulation measure about 0·05 mm. in thickness, and contain a great many spicules; the smaller ones are usually only one spicule broad. The larger fibres of the main skeleton measure about 0·07 mm. in thickness. The spicules are very small and slender, slightly curved oxea, measuring about 0·1 by 0·004 mm.

Locality.—Cape York, Torres Strait; 3 to 11 fathoms.

Chalina sp. (*b*).

A single compressedly lobate specimen, 75 mm. in height by 25 mm. in breadth near the top, and about 12 mm. thick. *Colour* in spirit dirty yellow. *Texture*

extremely soft and spongy, elastic, fibrous, tough. *Surface* granulated. *Dermal membrane* thin and transparent, with fairly numerous, rather large pores. *Oscula* on the top and lateral margins of the sponge.

Skeleton.—Very well developed; (*a*) *Dermal;* a reticulation of spiculo-fibre supporting the dermal membrane; with irregular polygonal meshes and fibre varying in thickness. (*b*) *Main;* a rectangularly-meshed reticulation of fairly stout spiculo-fibre in which primary and secondary lines are readily distinguished, the ends of the primary fibres commonly projecting for a short distance beyond the level of the dermal reticulation. The primary fibres measure up to about 0·07 mm. thick, and the secondary fibres are a little thinner; in all the fibres the amount of silica bears no proportion to the amount of horny matter, for the spicules, though polyserially arranged, are of hair-like thinness.

Spicules.—Subcylindrical, or more or less abruptly pointed oxea, measuring only about 0·09 by 0·0014 mm.

This species seems to come near to *Chalina finitima*, Schmidt, but the spicules are very slender, and on the whole we have thought it best not to make an identification.[1]

Locality.—Station 162, April 2, 1874; lat. 39° 10′ 30″ S., long. 146° 37′ 0″ E.; Bass Strait; depth, 38 fathoms; bottom, sand and shells.

Genus *Siphonochalina*, Schmidt (Pls. VII., XLVI.).

1868. *Siphonochalina*, Schmidt, Spong. d. Küste v. Algier, p. 7.
1882. *Tubulodigitus*, Carter, Ann. and Mag. Nat. Hist., ser. 5, vol. ix. p. 367.

Sponge tubular; tubes smooth, both inside and out, usually narrow, each with a large round opening at the summit.

Schmidt's original diagnosis (*loc. cit.*) runs "Verzweigte oder unverzweigte Röhren. Die Oberfläche dicht, indem zwischen den wenig vorragenden Enden der radiären Fasern ein feineres, dichteres Fasernetz sich ausbreitet."

We have to distinguish between two genera of tubular Chalinine sponges, in the one (*Siphonochalina*) the surface is smooth both inside and out, while in the other the outer surface is beset with large, rugged, spinous processes; for the second genus Vosmaer has proposed the name *Spinosella*[2] in place of the old name *Tuba*, which was already occupied. Schmidt's first described species of *Siphonochalina* is *Siphonochalina coriacea* (*loc. cit.*), which is shown by his figure (Taf. ii. fig. 4) to be one of the smooth forms.

A very common feature in the genus is the marked annulation of the tubes, which seems to indicate successive stages of growth.

Unfortunately the genus *Spinosella* is unrepresented in the collection.

[1] *Cf.*, however, Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., 1884, pp. 399, 604.
[2] Bronn's Klass. u. Ordnung. des Thierreichs, Porifera, p. 342.

Siphonochalina intermedia,[1] Ridley and Dendy (Pl. VII. fig. 1; Pl. XLVI. fig. 3).

1886. *Siphonochalina intermedia*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 331.

Sponge (Pl. VII. fig. 1) (sessile? or stipitate?), bushily ramose. Branches stout, tubular, sometimes anastomosing, short as compared with those of the next species, averaging about 56 mm. in length and 16 mm. in diameter; each branch varies considerably in diameter in different parts of its length, and is broadest near the summit. All the branches tend to grow vertically upwards. The total height of the single specimen in the collection is 87 mm. and the breadth 116 mm., but something seems to have been cut off from it. *Colour* in spirit greyish-yellow. *Texture* soft and spongy; tough and fibrous. *Surface* smooth, glabrous, with a reticulate appearance due to the underlying tissues appearing through the delicate, transparent dermal membrane. *Oscula*, large circular openings, one at the summit of each branch, about 8 mm. in diameter.

Skeleton.—(*a*) *Main;* the main skeleton, as seen in vertical section (Pl. XLVI. fig. 3) is a very regular, rectangularly-meshed network of spiculo-fibre, the primary fibres running vertically to the surface, and the secondary ones crossing them at right angles. Both primary and secondary fibres are rather slender, and have a core of polyserially arranged, slender, oxeote spicules. The amount of horny matter in each fibre is large; in the primary fibres there are many more spicules than in the secondary ones. The fibres of both sets measure about 0·032 mm. in diameter. There are also very numerous oxeote spicules scattered through the choanosome between the fibres. (*b*) *Dermal;* the true dermal skeleton is a very delicate, triangularly or polygonally-meshed reticulation of spiculo-fibre, the fibre forming each side of a mesh being composed of a single spicule and a very large proportion of horny matter. (When mounted in Canada balsam the horny fibre is rendered almost invisible, and the dermal skeleton then appears as a unispicular reticulation of oxeote spicules.) The dermal skeleton is supported on the ends of the primary fibres, which also form the nodes in a much coarser reticulation of stouter spiculo-fibre lying immediately below it.

Spicules.—Slender oxea, rather abruptly pointed, measuring up to about 0·1 mm. in length, and up to about 0·006 mm. in thickness, but usually slenderer.

This sponge certainly comes very close to Esper's *Spongia tubulosa*,[2] but the spicules in that species are, according to Ehlers,[3] twice as thick as in ours. Possibly *Siphonochalina intermedia* should be regarded as only a variety of *Spongia tubulosa*, but until more is known of the skeleton arrangement in the latter species the two had better remain distinct; as regards external form, they are almost identical (*vide* Esper's figure, *loc. cit.*).

Locality.—Port Jackson; 7 to 8 fathoms. One specimen.

[1] This species and the next were also obtained by Dr. v. Lendenfeld, who first used the specific names *intermedia* and *annulata* in his MS. Catalogue.

[2] Fortsetz. der Pflanzenthiere, pt. i. p. 196, pl. liv.

[3] Die Esper'schen Spongien, p. 19.

Siphonochalina annulata, Ridley and Dendy (Pl. VII. fig. 2).

1886. *Siphonochalina annulata*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 331.

Sponge (Pl. VII. fig. 2) rooted, stipitate, ramose. Branches long, tubular, rather slender, very distinctly annulated, often anastomosing with one another. Mode of branching irregular. Root large and much branched; stem short and slender. The largest specimen measures about 300 mm. in total height, including the root. The branches average a little over 12 mm. thick at the centre of each joint; and each joint is commonly a little less than 12 mm. long, though in this respect there is considerable variability. *Colour* in spirit doubtful (now a rusty red, but this may be due to the specimen having been packed in an iron box). *Texture* soft and spongy, but tough and fibrous. *Surface* glabrous. *Dermal membrane* very thin and transparent, firmly adherent to the underlying tissues. *Oscula;* there is one large circular osculum at the summit of each branch.

Skeleton.—(*a*) *Dermal;* a reticulation of rather stout spiculo-fibre, containing a very large proportion of horny matter and few spicules, abundantly echinated by outwardly projecting tufts of spicules. (*b*) *Main;* a feebly-developed, subrectangularly-meshed reticulation of spiculo-fibre, about 0·07 mm. in diameter, cored by spicules arranged polyserially; the rectangular character of the reticulation, as is very commonly the case, becomes lost in the deeper parts of the sponge.

Spicules.—Slightly curved, subfusiform oxea, sharply and rather gradually pointed, measuring about 0·1 by 0·0065 mm.

The most characteristic feature of this species is its external form, and more especially the extent to which the annulation of the branches, a not uncommon feature in Chalinine sponges, is carried. It is distinguished by this character and by the greater length of the branches from *Siphonochalina tubulosa*, Esper, and *Siphonochalina intermedia*, nobis.

Locality.—Station 162, April 2, 1874; lat. 39° 10′ 30″ S., long. 146° 37′ 0″ E.; Bass Strait; depth, 38 fathoms; bottom, sand and shells. Two specimens.

Family II. Heterorrhaphidæ.[1]

1886. *Heterorrhaphidæ*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 332.

Megasclera of various forms; microsclera commonly present, but never chelæ.

Subfamily 1. Phlœodictyinæ.

1882. *Phlœodictyina*, Carter, Ann. and Mag. Nat. Hist., ser. 5, vol. x. p. 117.

Sponge massive, consisting of a central, usually more or less globular, solid body, with closed (? or open) tubular processes (fistulæ) projecting from it. Free or attached. With a well-marked external rind, composed of an outermost, thin but distinct, transparent

[1] ἕτερος, different; ῥαφίς, needle.

membrane, a dermal network of spicules, and a subjacent bast-like layer of reticulating spiculo-fibres. The interior of the sponge is composed of a compact reticulate tissue, containing both spiculo-fibres and free spicules, and penetrated by branches of the canal system. Megasclera, oxea, sharp-pointed or blunt, passing into strongyla in some species. In one genus (*Oceanapia*) microsclera are present in the form of sigmata.

Genus *Rhizochalina*, Schmidt (Pls. VIII., IX.).

1867. *Biemna, pars*, Gray, Proc. Zool. Soc. Lond., 1867, p. 538.
1870. *Rhizochalina*, Schmidt, Spong. Atlant. Gebiet., p. 35.
1882. *Phlœodictyon, pars*, Carter, Ann. and Mag. Nat. Hist., ser. 5, vol. x. p. 122.

No microsclera present.

Rhizochalina fistulosa,[1] Bowerbank, sp. (Pl. VIII. figs. 2, 2*a*; Pl. IX. fig. 4).

1873. *Desmacidon fistulosa*, Bowerbank, Proc. Zool. Soc. Lond., 1873, p. 19, pl. iv. figs. 7, 8.
1884. *Rhizochalina fistulosa*, Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., p. 420.

Sponge (Pl. VIII. fig. 2) more or less globular, solid, with fistulæ arising abruptly from all parts of the surface. *Colour* in spirit yellowish to white, when dry light brownish-yellow (Bowerbank's specimen). *Size* of the body very variable, from 6 mm. in diameter upwards. *Fistulæ* broken off (?) in all cases so as to exhibit open ends, no branching visible. *Texture* firm and compact throughout in well-preserved specimens. In broken specimens from a great depth the internal portion appears to have undergone disintegration and run out, leaving little but the external rind formed mainly of the tough bast-like layer. *Surface* smooth, covered with a very thin transparent membrane.

Skeleton.—(*a*) A dermal network of oxeote spicules, which are a trifle shorter than those lying below, measuring 0·213 mm. in length. (*b*) A bast-like reticulation of spiculo-fibres, which are, however, not so coarse and stout as in *Oceanapia robusta*. (*c*) A reticulation of spiculo-fibre filling up the centre of the sphere and supporting the canal systems. Some of the canals are lined by a very dense layer of oxeote spicules arranged vertically to their walls, and not collected into fibres.

Spicules.—Oxea (Pl. IX. fig. 4), usually slightly curved, moderately sharp, tapering more abruptly towards the ends, but much less abruptly than in *Rhizochalina putridosa*, and measuring in the deeper parts of the sponge 0·265 by 0·0126 mm.

[1] Since this account was written we have discovered in one of the specimens from Station 188, which we have here referred to *Rhizochalina fistulosa*, numerous sigmata. This fact necessarily modifies our views both as to the species and genus. Probably *Rhizochalina*, Schmidt, and *Oceanapia*, Norman, should be united in one genus, but it is now too late to make any such radical alteration in the present work. As regards the species *Rhizochalina fistulosa*, it is still very possible that we are correct in our determination, and that the sigmata have hitherto simply been overlooked, as Bowerbank at first overlooked them in describing his *Desmacidon Jeffreysii* (=*Oceanapia robusta*), *cf.* Mon. Brit. Spong., vol. ii. p. 347, and vol. iii. p. 162.

This species, originally described and figured by Bowerbank (*loc. cit.*) from Freemantle, Australia, is fairly well represented in the Challenger collection. Bowerbank obtained two specimens, now in the British Museum, both of which are very considerably larger than any of the Challenger examples. The largest of the latter is only about 43 mm. in greatest diameter, while the smaller of Bowerbank's specimens has a greatest diameter of about 57 mm. Both of Bowerbank's specimens are imperfect, the lower surfaces having been very much abraded; hence, perhaps, arises Carter's diagnosis:—"Tubular appendages '*above only*,'"[1] which certainly does not apply to the Challenger specimens (Pl. VIII. fig. 2). The spicules of the Challenger specimens agree closely in size and form with those of Bowerbank's specimen.

Three of the examples obtained by the Challenger, including the largest, are of doubtful locality; the outside label says "off Bermuda," and the inside label "off Bahia, shallow water." Sixteen small specimens, varying from about 6 mm. to about 37 mm. in maximum diameter, and in shape from fusiform to globular, were obtained by the Challenger off the south-west corner of New Guinea, giving a remarkably wide distribution for this species. With the exception of the specimens from off the Azores, the species does not appear to range to any great depth.

Localities.—Station 73, June 30, 1873; lat. 38° 30′ N., long. 31° 14′ W.; depth, 1000 fathoms; bottom, Pteropod ooze; bottom temperature, 39°·4. A number of broken fragments of tubes and portions of the outer rind of the body, with a yellowish, amorphous mass, containing loose spicules, adhering to them.

Station 188, September 10, 1874; lat. 9° 59′ S., long. 139° 42′ E.: off south-west corner of New Guinea; depth, 28 fathoms; bottom, green mud. Sixteen specimens.

Habitat.—Freemantle, Australia (Bowerbank); Arafura Sea, north-west coast of Australia (Ridley); off south-west corner of New Guinea (Challenger); (?) off Bahia (Challenger); west of Azores (Challenger).

Rhizochalina putridosa (? Lamarck, sp.) (Pl. VIII. figs. 5, 5*a*; Pl. IX. figs. 1, 7).

1815. *? Alcyonium putridosum*, Lamarck, Mém. Mus. Hist. Nat. Paris, vol. i. p. 168.
1886. *Rhizochalina putridosa*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 332.

Sponge (Pl. VIII. fig. 5) massive and lumpy, subspherical. An upper and a lower half are distinguishable; from the upper half arise very numerous short fistulæ, scattered irregularly over the surface and all pointing more or less vertically upwards, not radiating in all directions as in the preceding species. Lower half almost without trace of fistulæ. Fistulæ nearly all broken off close to the surface; usually (when perfect) short, broad, finger-like (Pl. VIII. fig. 5*a*), closed at the ends, measuring about 25 mm. in length by 6 to 12 mm. in width. *Size* of body, 93 to 137 mm. in diameter. *Colour* in spirit, pale yellow. *Texture*, solid and very dense throughout, penetrated by

[1] *Ann. and Mag. Nat. Hist.*, ser. 5, vol. x. p. 121.

wide ramifying tubes which open into the fistulæ. *Surface*, very uneven, covered with numerous bladder-like, almost glabrous swellings. The whole much encrusted with foreign organisms, Serpulæ, Polyzoa, Sponges, &c.

Skeleton.—Arranged as in *Rhizochalina fistulosa* into (*a*) a dermal network of hastately-pointed oxeote spicules, not very closely aggregated, and (*b*) a rather delicate reticulation of spiculo-fibres, forming subequal polygonal meshes (the bast-layer), the fibres composed of oxeote spicules similar to those of the dermal layer. (*c*) A fairly close reticulation of stouter fibres filling up the interior of the sphere, and composed of spicules like those of the dermal layer, with, as usual, numerous unattached spicules lying between the fibres.

Spicules.—Hastately pointed oxea (Pl. IX. fig. 1), slightly curved and abruptly, but fairly sharply, pointed, measuring about 0·195 by 0·013 mm.; size and shape very uniform throughout.

The rind, composed of the dermal membrane and the subjacent bast-layer, is much more firmly attached to the underlying tissues in this species than in, for example, *Rhizochalina pedunculata* (below). At the ends of the fistulæ (Pl. IX. fig. 7) the arrangement of the dermal spicules is different to what it is on the body (as shown in the figure).

These large specimens present many features of great interest. The one figured (Pl. VIII. fig. 5) is firmly attached to a slab of rock by one side. There is a very distinct division into upper and lower surfaces, the fistulæ being chiefly confined to the upper surface.

We at first identified this well-marked form with *Alcyonium putridosum*, described by Lamarck (*loc. cit.*) from Australian Seas ("port du roi Georges"). There can be no doubt that Lamarck's *Alcyonium putridosum* is some species of *Rhizochalina*, and that it is nearly allied to *Rhizochalina putridosa*, but as there is not sufficient evidence to make the identification a certainty, we have given the synonym with a query.

Localities.—Station 162, April 2, 1874; lat. 39° 10′ 30″ S., long. 146° 37′ E.; Bass Strait; depth, 38 fathoms; bottom, sand and shells. Three large specimens.

Off Port Jackson, 30 to 35 fathoms. One large specimen.

Off Bahia, 7 to 20 fathoms. Some fragments of fistulæ, which seem to be referable to this species (?).

Habitat.—Australian Seas (Challenger); off Bahia (Challenger).

Rhizochalina singaporensis, Carter, sp.

1883. *Phlœodictyon singaporense*, Carter, Ann. and Mag. Nat. Hist., ser. 5, vol. xii. p. 326, pl. xiii. fig. 17.

1884. *Rhizochalina singaporensis*, Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., p. 421, pl. xli. fig. *s*.

With this species we identify a single fistula, in a bad state of preservation and of doubtful locality. The species is described by Carter (*loc. cit.*), and with only a fragment before us it does not seem advisable to go into further details.

Locality.—(?) Station 135, October 15, 1873 ; lat. 37° 1′ 50″ S., long. 12° 19′ 10″ W. ; Tristan da Cunha ; depth, 360 fathoms ; bottom, volcanic sand.

Habitat.—Singapore (Carter) ; Prince of Wales Channel, West and Alert Islands, Torres Strait (Ridley) ; (?) Tristan da Cunha (Challenger).

Rhizochalina pedunculata, Ridley and Dendy (Pl. VIII. fig. 1 ; Pl. IX. figs. 2, 6).

1886. *Rhizochalina pedunculata*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 332.

Sponge (Pl. VIII. fig. 1) irregularly rounded, slightly elongated, with one end drawn out into a short, stout peduncle, to the extremity of which is firmly attached a quantity of black sand. The sponge has evidently lived in an erect position, attached to the bottom by the peduncle. Height, inclusive of peduncle, 40 mm. ; breadth 25 mm. Unfortunately, a portion of the peduncle is broken off obliquely, leaving only a fragment of the base. Irregularly scattered over the surface of the sponge occur a number of fistulæ, about 4 mm. in diameter, all broken off (? some naturally terminating) close to the surface of the sponge, so as to present the appearance of so many oscula ; nine such fistulæ are present, varying a little in width. *Colour* of the body a dirty brownish-yellow. The bast-layer and dermal membrane together form a very thin coating to the sponge, no thicker than a sheet of writing paper, which readily peels off from the underlying tissues. *Surface* slightly rough and wrinkled. *Texture* firm and compact throughout. Wide canals penetrate right to the centre, converging and opening into the bases of the fistulæ, which probably act as oscular tubes.

Skeleton.—Arranged as in *Rhizochalina fistulosa*, with (*a*) a dermal network of chiefly oxeote spicules, lying immediately below the thin, transparent external membrane. The spicules of the dermal network vary very greatly in size and form. We have (1) sausage-shaped (strongylote) spicules (Pl. IX. fig. 2) with rounded ends, nearly straight or very slightly curved, measuring 0·106 by 0·01 mm., 0·23 by 0·013 mm., 0·19 by 0·017 mm., &c. It is not uncommon to find small strongylote spicules with a central bulbous inflation (Pl. IX. fig. 2, *b*, *c*) ; these are probably young forms. (2) More numerous, oxeote spicules, nearly straight, or slightly curved, sometimes becoming blunted at the end, varying greatly in size, from 0·09 by 0·0047 mm. to 0·25 by 0·009 mm. (There can be little doubt that the smaller spicules are here, as in other cases, simply young forms, which have not yet attained their maximum size.) (*b*) A bast-like reticulation of spiculo-fibres, which in this species forms only a very thin layer, consisting of a unilamellar network of fibres, composed of oxeote (and strongylote ?) spicules similar to those forming the dermal network. The fibres are very compact, averaging about 0·1 mm. in diameter. (*c*) A rather scanty reticulation of spiculo-fibres, ramifying through the interior of the sphere and supporting the canal system. Also a great number of loose

spicules, mainly arranged perpendicularly to the walls of the smaller canals. The latter spicules are mostly slender, slightly curved oxea; sometimes they become blunted; average maximum size, 0·23 by 0·009 mm.

Spicules.—Oxeote to strongylote, size variable (*vide supra*).

We were at first inclined to refer this sponge to *Rhizochalina singaporensis*, Carter, but closer examination shows certain well-marked differences, although in some respects the two forms approach one another. Thus in *Rhizochalina pedunculata*, the dermal membrane contains a number of cylindrical spicules, some of which attain great size (*vide* measurements), but which are, however, nearly or quite straight, while the deeper spicules sometimes show a strong tendency to become blunted. In Carter's species there are a great number of cylindrical spicules, but they are mostly very short, stout, and strongly bent.

The presence of a distinct peduncle (whence the specific name) may possibly be regarded as characteristic, although, as there is only one specimen, it is impossible to say whether it is a constant feature.

It is perhaps noteworthy that a great number of the oxeote spicules of this species show a tendency to become slightly rough and jagged at the points, suggesting the idea that they have begun to undergo absorption (that is to say, as a *vital* process, not the absorption occurring in dead spicules, which these are not).

Locality.—Api, New Hebrides, 60 to 70 fathoms.

Genus *Oceanapia*, Norman (Pl. IX.).

1869. *Oceanapia*, Norman, Brit. Assoc. Rep. for 1868, p. 334.

Microsclera (viz., sigmata) present.

Oceanapia robusta, Bowerbank, sp. (Pl. IX. fig. 3).

1866. *Isodictya robusta*, Bowerbank, Mon. Brit. Spong., vol. ii. p. 304.
1866. *Desmacidon Jeffreysii*, Bowerbank, Mon. Brit. Spong., vol. ii. p. 347.
1867. *Gellius robustus*, Gray, Proc. Zool. Soc. Lond., p. 538.
1867. *? Biemna jeffreysii*, Gray, Proc. Zool. Soc. Lond., p. 539.
1869. *Oceanapia Jeffreysii*, Norman, Last Rep. Dredging Shetland Isles, Brit. Assoc. Rep. for 1868, p. 334.

Sponge more or less globular, solid, with a number of tubular processes or *fistulæ* coming off abruptly from all parts of the surface. *Colour* in spirit yellowish to nearly white. *Size* (of the body) very variable. *Fistulæ* 75 to 100 mm. long by 6 mm. wide, closed at the ends, where they exhibit an irregular branching into four or five or more short, finger-like processes, resembling the tubes of *Rhizochalina oleracea*, figured by Schmidt (Spong. Atlant. Gebiet., pl. iv. fig. 1). *Texture* in well-preserved specimens firm and compact throughout. *Surface* smooth.

Skeleton.—The skeleton consists, as in the *Rhizochalinæ*, of three kinds of network, viz., (*a*) a dermal network of oxeote spicules lying immediately beneath a distinct, thin dermal membrane. (*b*) A coarse, bast-like reticulation of very stout and dense fibres, composed also of oxeote spicules. (*c*) A less dense reticulation of spiculo-fibre filling up the centre of the sphere and giving support to the canal system; in form and size the spicules are the same as in the preceding.

Spicules.—(*a*) *Megasclera;* oxea (Pl. IX. fig. 3, *a*, *b*, *c*), size about 0·19 by 0·0115 mm. (*b*) *Microsclera*, extremely abundant in the deeper sarcode in the form of small sigmata (Pl. IX. fig. 3, *d*), measuring 0·038 by 0·0032 mm.

This common Shetland species is very poorly represented in the Challenger collection, only two specimens of the body, a small one about 16 mm. in diameter, and a larger one about 31 mm. in diameter, and a few detached fistulæ being present. The oxeote spicules are somewhat shorter than usual, measuring 0·19 by 0·011 mm., while those of the type measure 0·19 to 0·25 by 0·011 mm.

Unfortunately, in the case of all the specimens, including the two bodies, there is some slight doubt as to the exact locality where they were obtained. According to the label on the outside of the bottle they were obtained "off Bermuda," while according to a label inside the bottle, they were obtained "off Bahia, shallow water."

Probably the *Rhizochalina (?) fibulata*, described in four lines by Schmidt (Spong. Meerb. Mexico, p. 76) as a new species, from Barbados, 288 fathoms, and possessed of numerous sigmata, is also referable to *Oceanapia robusta*, although the description, which is taken only from a fragment, is too short to make an identification practicable.

Locality.—Bahia (?).

Habitat.—Shetland Isles (Norman); ? Barbados (Schmidt); ? Bahia (Challenger).

Subfamily 2. Gelliinæ.

1872. *Gelliadae* (*pars*), Gray, Ann. and Mag. Nat. Hist., ser. 4, vol. ix. p. 449.
1886. *Gelliina*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 332.

Megasclera all diactinal, oxea or strongyla. Microsclera present, viz., sigmata or toxa. No rind nor fistulæ.

Genus *Gellius*, Gray (Pls. VIII., XIII., XXVI.).

1867. *Gellius*, Gray, Proc. Zool. Soc. Lond., p. 538.
1867. *Asychis*, Gray, Proc. Zool. Soc. Lond., p. 539.
1870. *Desmacodes*, Schmidt, Spong. Atlant. Gebiet., p. 5.
1880. „ Vosmaer, Notes Leyden Mus., vol. ii. p. 104.
1882. *Fibularia*, *pars*, Carter, Ann. and Mag. Nat. Hist., ser. 5, vol. ix. p. 282.
1886. *? Fibulia*, Carter, Ann. and Mag. Nat. Hist., ser. 5, vol. xvii. p. 51.

Very little spongin present, never forming distinct fibres.

Gray's original diagnosis runs as follows:—"Sponge massive, minutely hispid.

Skeleton regularly netted. Spicules of two kinds:—(1) Fusiform. (2) Bihamate, simple, and contorted." The increase of our knowledge, due to recent discoveries, has necessitated several not very serious alterations in the original diagnosis. Thus, it has been found advisable to omit the words "sponge massive," for we now know at least one species, *Gellius calyx*, nobis, which has a beautifully symmetrical and elegant form. Again, the genus has had to be enlarged to admit certain forms with toxa, or with long, straight, hair-like microsclera, although at present only a few such are known, viz., *Gellius angulatus*, Bowerbank, sp., *Gellius arcoferus*, Vosmaer, *Gellius flabelliformis*, nobis, *Gellius pyriformis*, nobis; and it is possible that these and kindred forms may subsequently require a separate genus or subgenus to include them.

The smooth oxeote character of the megasclera appears to be a very good and constant point, but it is important to notice that the ends of the oxea may become completely rounded off, as in *Gellius pyriformis* and *Gellius carduus*, the spicules then becoming almost cylindrical (strongylote), but showing their real nature by the marked manner in which they still taper to each rounded extremity, and also by their close correspondence in shape and curvature with those of allied forms. Intermediate stages in this process of rounding off are also sometimes met with.

Vosmaer, in the Notes from the Leyden Museum (*loc. cit.*), does not accept the genus *Gellius* at all, but has in its place *Desmacodes*, Schmidt. In his later work on the Porifera in Bronn's Klassen und Ordnungen des Thierreichs, he, however, substitutes *Gellius* for *Desmacodes*, but gives the genus a much wider scope than we are inclined to admit; his diagnosis runs as follows:—"Stabnadeln glatt oder gedornt; Spongin wenig entwickelt. Keine Anker. Statt dessen Haken und Bogen. Atlantischer und Arctischer Ocean (Mittelmeer?). Untief bis 180 Fad."[1] The Challenger dredgings extend the range of depth at which *Gellius* occurs to 600 fathoms, and show it to be as well established in the deep-sea as in shallow water.

Gellius varius, Bowerbank, sp. (Pl. VIII. fig. 4).

1875. *Halichondria varia*, Bowerbank, Proc. Zool. Soc. Lond., p. 292.
1875. *Isodictya virgata*, Bowerbank, Proc. Zool. Soc. Lond., p. 294.
1880. ? *Desmacodes fibulatus*, Vosmaer, *pars*, Notes Leyden Mus., vol. ii. p. 105.
1884. *Gellius varius*, Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., p. 424.

With this species we identify several good-sized fragments from Station 208. They are all more or less cylindrical, and the longest is a branch about 80 mm. long by about 6 mm. in diameter, slightly forked at the extremity. Other pieces are thicker, much more distinctly branched, and the branches show a strong tendency to anastomose. The measurements of the spicules are as follows:—Oxea about 0·22 by 0·013 to 0·0145 mm.

[1] *Vide* Klass. u. Ordnung. des Thierreichs, Porifera, p. 349.

Sigmata about 0·04 by 0·0015. It is needless to give further details concerning an already well-known species; the reasons for uniting *Halichondria varia*, Bowerbank, and *Isodictya virgata*, Bowerbank, have already been given by Ridley in the "Alert" Report (*loc. cit.*).

Locality.—Station 208, January 17, 1875; lat. 11° 37′ N., long. 123° 31′ E.; Philippine Islands; depth, 18 fathoms; bottom, blue mud. A number of fragments.

Habitat.—Strait of Malacca (Bowerbank); Port Darwin (Ridley); Philippines (Challenger).

Gellius carduus, Ridley and Dendy (Pl. VIII. fig. 3; Pl. XIII. fig. 7).

1886. *Gellius carduus*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 333.

Sponge (Pl. VIII. fig. 3) sessile, more or less oval, or egg-shaped. *Size* of the two most perfect specimens about 33 mm. long by 20 mm. broad. *Colour* in spirit pale greyish-yellow. *Texture* loose but firm. Interior of the sponge cavernous, owing to the numerous wide canals by which it is traversed. *Surface* raised into numerous angular prominences, many of which have oscula at their summits. *Dermal membrane* distinct, hyaline, covering large subdermal cavities, and pierced by numerous scattered pores, about 0·052 mm. in diameter. *Oscula* scattered singly on the summits of angular prominences.

Skeleton.—(*a*) *Dermal;* consisting of a very beautiful unispicular reticulation of large, stout, blunted oxeote spicules (exhibiting occasionally a tendency to form loose, long fibres). (*b*) *Main;* consisting of a loose reticulation of similar spicules, not united to form definite fibres. Hence the firmness of the sponge is due rather to the large amount of tough membranes present, supported by loose spicules, than to the presence of any definite spiculo-fibre.

Spicules.—(*a*) *Megasclera;* of one kind only, viz., blunted oxea (Pl. XIII. fig. 7), slightly bent, and tapering to a rounded extremity at each end. Size 0·6 by 0·023 mm. (*b*) *Microsclera;* numerous small sigmata of the usual shape, measuring 0·02 by 0·0012 mm.

This species is readily distinguished by its very characteristic external form, the surface resembling that of a large thistle-leaf, whence the specific name. The shape of the skeleton spicules is also very characteristic; they might be described as strongyla, tapering slightly towards each end; but there can be no doubt that they are simply blunted oxea.

Localities.—Station 148A, January 3, 1874; lat. 46° 53′ S., long. 51° 52′ E.; depth, 240 to 550 fathoms; bottom, hard ground, gravel, shells. One specimen, attached to a pebble..

Off Prince Edward Island, December 27, 1873; depth, 85 to 150 fathoms. Three specimens.

Off Marion Island, 50 to 75 fathoms. One specimen.

Gellius carduus, var. *magellanica*, nov. (Pl. XIII. fig. 6).

Sponge massive, sessile. Shape elongately oval, size about 62 mm. by 25 mm.; tapering irregularly towards each end. *Colour* in spirit pale brownish-yellow. *Texture* rather firm and compact, but brittle. *Surface* glabrous but uneven. *Dermal membrane* distinct, rather coarse. *Oscula* irregularly scattered over the upper surface.

Skeleton.—(*a*) *Dermal;* in some parts a unispicular reticulation of oxeote spicules; in other parts broad bands of loose spiculo-fibre are also present. (*b*) *Main;* a reticulation of loose but distinct spiculo-fibre, main fibres running more or less vertically to the surface and others at right angles to these; but these two main directions are only very roughly marked out. The fibres themselves are about 0·175 mm. in diameter.

Spicules.—(*a*) *Megasclera;* stout oxea (Pl. XIII. fig. 6), tapering rather gradually to a rather blunt point at each end; measuring about 0·49 by 0·022 mm. (*b*) *Microsclera;* numerous very small sigmata measuring 0·019 by 0·0008 mm.

This is a very interesting geographical variety from the Strait of Magellan. The main features in which it differs from the type specimens of *Gellius carduus* concern the oxeote spicules which, in the variety in question, are much more pointed and a good deal shorter than in the type; the skeleton-fibre also seems to be better developed.

Locality.—Station 311, January 11, 1876; lat. 52° 45′ 30″ S., long. 73° 46′ W.; Strait of Magellan, west end; depth, 245 fathoms; bottom, blue mud; bottom temperature, 46°·0. One specimen.

Gellius lævis, Ridley and Dendy (Pl. XIII. fig. 8).

1886. *Gellius lævis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 333.

This species agrees very closely in spiculation with the typical specimens of *Gellius carduus*. The spicules, both megasclera (Pl. XIII. fig. 8) and microsclera, are of the same shape and almost of the same size. The chief points of difference concern the surface and size of the specimens. The surface is not nearly so uneven as in *Gellius carduus;* the oscula are large and round, and their margins flush with the general surface of the sponge. The specimens are also much larger than the types of *Gellius carduus*, the largest being massive and cake-like, and measuring 143 mm. in length, 81 mm. in breadth, and about 31 mm. in average thickness.

Two specimens were obtained, both of which were infested by a very beautiful and peculiar little Isopod, which occurs also on a fine *Esperella* from the same Station.

Locality.—Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; off the mouth of the Rio de la Plata; depth, 600 fathoms; bottom, green sand; bottom temperature, 37°·2. Two fine specimens.

Gellius glacialis, Ridley and Dendy (Pl. VIII. fig. 7; Pl. XIII. figs. 1, 15, 19).

1886. *Gellius glacialis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 333.

Sponge (Pl. VIII. fig. 7) massive, sessile; shape very various, globular, lobate, or cylindrical. *Size*, ranging up to 81 mm. long by about 31 mm. broad (a roughly cylindrical specimen). *Colour* in spirit very pale greyish-yellow. *Texture* firm, but very brittle. (The sponge has very much the appearance of a mass of half-melted snow, whence the specific name.) *Surface* even, but rather rough; dermal layer distinct, readily flaking off; composed of the dermal membrane supported by a reticulation of spicules. The *dermal membrane* itself is extremely delicate and has almost everywhere been removed, probably washed off in coming up in the dredge. It is further supported by abundant, large sigmata. *Pores;* as far as can be made out these are rather large and not abundant. *Oscula* large, irregularly scattered, having their margins flush with the surface of the sponge.

Skeleton.—(*a*) *Dermal* (Pl. XIII. fig. 19); consisting of a very beautiful, almost unispicular reticulation of large, stout, oxeote spicules. (*b*) *Main;* consisting of a very loose and irregular reticulation of spicules like those forming the dermal layer, and of about the same size (Pl. XIII. fig. 1). Sometimes a few spicules lie more or less parallel and close to one another, so as to form a rudimentary spiculo-fibre. The whole reticulation is very delicate and fragile, and a very small amount of cementing substance (spongin) is present at the points where the spicules touch one another, at or near their apices.

Spicules.—(*a*) *Megasclera;* large oxea (Pl. XIII. fig. 1), slightly curved, and tapering rather abruptly to a sharp point at each end; size, 0·65 by 0·036 mm. (*b*) *Microsclera;* numerous, large sigmata (Pl. XIII. fig. 15) of the usual shape, occurring very abundantly in the dermal membrane; size up to 0·07 by 0·0063 mm. Smaller ones, probably young forms, also occur.

This species may be most easily recognised by its external appearance. It is probably nearly related to *Gellius carduus*, nobis, but has not the sharp and projecting edges to the oscula which characterise that species. It is exceedingly delicate. In the specimens before us the soft parts have been almost entirely washed away, leaving a very fragile skeleton. Owing to the absence of soft parts and of any coarse fibre the specimens have a peculiar translucent look.

Locality.—Station 142, December 18, 1873; lat. 35° 4′ S., long. 18° 37′ E.; Agulhas Bank; depth, 150 fathoms; bottom, green sand; bottom temperature, 47°·0. About twenty-five specimens.

Gellius glacialis, var. *nivea*, nov. (Pl. VIII. fig. 8; Pl. XIII. figs. 4, 12).

Sponge (Pl. VIII. fig. 8) incrusting, amorphous, in the form of a small round cushion, filling up the angle between the branches of a Polyzoon. Diameter about 12 mm. thickness about 8 mm. *Colour* in the dry state white; appearance like fleecy snow, whence the varietal name. *Texture* brittle. *Surface* even, but rough, owing to the dermal membrane being absent. *Oscula* and *pores* unknown.

Skeleton.—A very loose reticulation of oxeote spicules, not united together into distinct fibres. This reticulation is very like that of *Gellius flagellifer*, nobis, but in that species it is just possible to speak of spiculo-fibre, while here the reticulation is so loose that the term is no longer admissible; there is, however, but little real difference in this respect between the two.

Spicules.—(*a*) *Megasclera;* oxea (Pl. XIII. fig. 4), tapering rather suddenly to a sharp point at each end. Slightly curved and measuring 0·53 by 0·02 mm. (*b*) *Microsclera* are present in the form of numerous sigmata (Pl. XIII. fig. 12) of the usual shape, but attaining a very great size, up to 0·145 by 0·0063 mm. Smaller ones are also present, probably young forms of the others.

It will be seen that both in the arrangement and form of the megasclera and in the great size of the sigmata this variety of the species comes very near to *Gellius flagellifer*, nobis; it is, however, easily distinguished by the very different shape and superior thickness of the large sigmata. The sponge has unfortunately been dried, so that the skeleton is the only part the structure of which can be satisfactorily made out. Judging from its small size it is probably a young form.

Locality.—Station 145, December 27, 1873; lat. 46° 43′ 0″ S., long. 38° 4′ 30″ E.; Prince Edward Island; depth, 140 fathoms; bottom, volcanic sand. One small specimen.

Gellius flagellifer, Ridley and Dendy (Pl. XIII. figs. 5, 10).

1886. *Gellius flagellifer*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 333.

Sponge massive, sessile, roughly triangular in shape,[1] the side of the triangle measuring a little over 25 mm. in length; thickness of the sponge from the centre of one triangular surface to the centre of the other 16 mm. *Colour* in spirit pale greyish-yellow. *Texture* soft, brittle. *Surface* even but slightly rough, probably owing to the dermal membrane having been in most parts rubbed off. *Dermal membrane* thin and transparent, with numerous scattered *pores* about 0·07 mm. in diameter. Only one distinct *osculum* visible at one side. A second specimen, very likely only a fragment, is cylindrical, 29 mm. long by 8 mm. in diameter.

Skeleton.—There is a dermal network of spiculo-fibre indistinguishable from the spiculo-fibre forming the skeleton at large. The deeper skeleton is composed of a loose,

[1] Perhaps a young specimen, incipiently lobose.

irregular reticulation of very loose spiculo-fibre, the meshes of which are about one spicule in breadth.

Spicules.—(*a*) *Megasclera;* stout, slightly curved oxea (Pl. XIII. fig. 5), tapering not very suddenly to a fairly sharp point at each end; size 0·42 by 0·018 mm. (*b*) *Microsclera;* sigmata (Pl. XIII. fig. 10) are present in great abundance, and attain to a great length and a high degree of curvature, being folded once on themselves, so as to resemble little whip-lashes (whence the specific name), the greatest length from curve to curve of these spicules is about 0·06 mm., thickness about 0·0021 mm., the real length is concealed by the curvature, and is, of course, much greater than that given. In addition to these long sigmata there are also present numerous smaller ones of the usual shape, possibly young forms of the others, size 0·044 by 0·0025 mm., &c. These smaller sigmata are especially abundant in the dermal membrane.

Only two small specimens of this sponge were obtained. The most characteristic features about it are the size and shape of the microsclera, which, taken together, are quite sufficient to distinguish it from any other *Gellius*.

Vosmaer mentions under "*Gellius vagabundus* (O. S.)," in The Sponges of the "Willem Barents" Expedition, 1880 and 1881, p. 29 (*sep*), a variety of that species possessing oxea and sigmata, similar in form to those of our species. His specimen, though containing a few styli, is obviously a true *Gellius* (*Gellius vagabundus* being *Desmacella* for us), and it is not improbably referable to *Gellius flagelliger*. It was obtained by the "Willem Barents" expedition of 1880, and hence probably in the Arctic Sea, though the exact locality is unknown. Having regard to the want of definite characters in this species, other than the form of the sigmata, we cannot further insist on the strong resemblance which this form bears to our species, as its locality is so far removed from that of *Gellius flagellifer*.

Locality.—Off Marion Island, 50 to 75 fathoms. Two small specimens.

Gellius calyx, Ridley and Dendy (Pl. VIII. figs. 6, 6*a*; Pl. XIII. figs. 2, 9).

1886. *Gellius calyx*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 334.

Sponge (Pl. VIII. fig. 6) consisting of a pyriform body attached by the narrow end to a long slender stalk, which is very slightly expanded at the base; body hollow, with a single large rounded opening at the summit (Pl. VIII. fig. 6*a*). The whole sponge closely resembling, in size and shape, the flower of a crocus. Length of stalk 50 mm. Mean diameter of stalk 2 mm. Length of body 33 mm., greater breadth of body 10 mm. Diameter of mouth 4 mm. *Colour* in spirit pale greyish-yellow. *Texture* of the body very soft, fragile and crumbling; of the stem hard and stringy. The fibres of the stalk appear to spread out on reaching the body, so that the lowest part of the latter is firm and dense. *Surface* minutely hirsute, even, but with numerous minute holes, probably

due to the dermal membrane having been in most parts rubbed off, exposing the subdermal cavities. *Dermal membrane* very thin and delicate, with numerous rounded *pores*, about 0·53 mm. in diameter.

Skeleton.—(1) Of the stalk. The stalk is composed of a thick, dense core of spiculo-fibre composed of closely packed, longitudinally arranged, oxeote spicules. Around this is a thin layer of soft tissues, containing numerous loosely placed spicules, both megasclera and microsclera. (2) Of the body. (*a*) *Dermal;* a very loose and irregular reticulation of oxeote spicules supporting the dermal membrane. (*b*) *Main;* a loose reticulation of oxeote spicules in which one can, however, distinguish certain loose main bands of spicules running in a direction vertical to the surface of the sponge. At the surface these spicules project freely, giving it a characteristic hirsute appearance. There are also numerous spicules placed transversely, running from one to another of the above mentioned main bands, the whole skeleton forming an irregular and but slightly coherent network.

Spicules.—(*a*) *Megasclera;* sharp-pointed oxea (Pl. XIII. fig. 2) tapering rather gradually towards each end. In the body they show a tendency to become blunted, and in the stalk to become irregularly pointed as if in process of absorption. Size about 0·5 to 0·7 mm. by 0·022 mm. (*b*) *Microsclera;* very numerous small sigmata (Pl. XIII. fig. 9) of the usual shape, but often scarcely, if at all, contorted, measuring 0·02 by 0·002 mm.[1]

The presence of a distinct stalk, the cup-like shape of the body, and the hirsute appearance of the surface, are all characters which serve readily to distinguish this species from all other known species of the genus. In the spicules themselves there is nothing characteristic. Owing to its well-defined and elegant external form this is perhaps the most remarkable species of the genus as yet known.

Locality.—Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; off the mouth of the Rio de la Plata; depth, 600 fathoms; bottom, green sand; bottom temperature, 37°·2. One specimen.

Gellius angulatus, Bowerbank, sp.

1866. *Halichondria angulata*, Bowerbank, Mon. Brit. Spong., vol. ii. p. 233; (vol. iii. p. 101, pl. xli. figs. 4–8).

1880. *Desmacodes angulatus*, Vosmaer, Notes Leyden Mus., vol. ii. p. 107.

Three small globular specimens of this sponge, the smallest about the size of a pea (8 mm. in diameter) and attached to a Polyzoon, the other two about 6 to 18 mm. in diameter, were obtained by the Challenger at Station 75, at a depth of 450 fathoms. The species has already been fully described and figured by Bowerbank (*loc. cit.*), with the exception that he omits all mention of the sigmata amongst the microsclera. That

[1] There are also a very few long, thin, hair-like spicules, very possibly foreign, but interesting, because similar ones occur in great abundance in another species of *Gellius*, from the same locality (*vide Gellius* sp., p. 46).

these occur in his species, is shown by a preparation in the Bowerbank collection in the British Museum. Vosmaer, presumably following Bowerbank, also omits to mention the sigmata. The discovery of these sigmata fully justifies the reference of this species to the genus *Gellius*.

The measurements of the spicules are as follows:—Oxea (megasclera) 0·29 to 0·34 by 0·009 to 0·01 mm. Toxa (microsclera) 0·08 by 0·0012 mm. Sigmata (microsclera) 0·019 by 0·0012 mm.

Locality.—Station 75, July 2, 1873; lat. 38° 38′ 0″ N., long. 28° 28′ 30″ W.; off the Azores; depth, 450 fathoms; bottom, volcanic mud. Three small specimens.

Habitat.—British Seas (Bowerbank); off Azores (Challenger).

Gellius flabelliformis, Ridley and Dendy (Pl. XXVI. figs. 5, 5*a*).

1886. *Gellius flabelliformis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 4, vol. xviii. p. 334.

Sponge (Pl. XXVI. figs. 5, 5*a*) erect, compressed, forming thin laminæ. The largest piece forms an erect, flattened, broadly expanded lobe, arising from a small woody base and rapidly expanding upwards; margin entire, thin, turned back; in addition to this backward curvature of the margin, which would appear most plainly in longitudinal section, the lamella is also curved in a direction at right angles to the former, the second curvature being most evident in horizontal section, and causing the sponge to become convex on one side and concave on the other. The specimen, in fact, resembles a piece broken off from a cup, with the lip turned back; it is not improbable that the sponge may sometimes be caliciform, but we do not think the present specimen has ever been so. Height of the largest piece 68 mm., greatest breadth 79 mm., thickness about 4 to 8 mm. Colour in spirit greyish-yellow. *Texture* very fragile. *Surface* even, with a deeply, though minutely, pitted appearance all over. On the convex side each little pit is covered over by the pore-bearing dermal membrane, but on the concave side the pits seem to represent the oscula, for we have been able to find none other. *Dermal membrane* very delicate indeed. *Oscula* (? minute, very abundant over the concave surface). *Pores*, very numerous rounded openings in the dermal membrane on the convex surface, measuring about 0·085 mm. in diameter, reducing the dermal membrane to a mere network. We have found none on the concave surface, but should not like to say for certain that they do not exist here, though probably, from the analogy of other flabellate sponges, they are almost or quite confined to the one surface.

Skeleton.—(*a*) *Dermal;* there is no very definite dermal skeleton on either side of the sponge, but on the pore-bearing side the toxa are enormously abundant and arranged in loose, irregularly reticulating, fibre-like tracts. (*b*) *Main;* a loose and quite irregular reticulation of oxeote spicules.

Spicules.—(*a*) *Megasclera;* large, smooth, fairly stout oxea, rather gradually and sharply pointed at each end, and with a slight bend in the centre; size, about 0·7 by 0·03 mm. (*b*) *Microsclera;* (1) large, stout, very strongly curved, sharply pointed, simple and contort sigmata, very abundant, measuring about 0·07 by 0·0063 mm.; (2) smooth, sharp-pointed toxa, with very obtuse central angle, unusually large, measuring about 0·18 by 0·0063 mm.; exceedingly abundant all through the sponge, more especially so lining the subdermal cavities.

Vosmaer's *Gellius arcoferus*,[1] an Arctic form, certainly comes very near to this species, especially if, as Dr. Vosmaer suggests, the real form is that of a fan; it differs, however, in the proportions of the sigmata and toxa, *inter se*, the former being very much smaller as compared with the latter than in *Gellius flabelliformis;* this much we can deduce from the figures, but as to the actual sizes of the spicules in *Gellius arcoferus*, we are unfortunately able to say nothing, for Dr. Vosmaer gives no measurements.

Gellius angulatus, Bowerbank, also approaches *Gellius flabelliformis* in spiculation, being also possessed of toxa, but differs in external form and in the very much smaller size of the microsclera.

Locality.—Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; off the mouth of the Rio de la Plata; depth, 600 fathoms; bottom, green sand; bottom temperature, 37°·2. One large piece and several small ones.

Gellius sp. (Pl. XIII. fig. 3).

Sponge consisting of a pear-shaped body, tapering to a point at one end, which has a fibrous appearance, and where possibly a stalk has been attached. Body solid. Length 29 mm., greatest breadth 12 mm. *Colour* in spirit pale greyish-yellow. *Texture* very soft and fragile. *Surface* even, slightly hirsute. *Oscula* small and scattered. *Dermal membrane* thin and delicate.

Skeleton.—Arranged much as in the body of *Gellius calyx*, altogether very loose.

Spicules.—(*a*) *Megasclera*, of one kind only, viz., oxeote (Pl. XIII. fig. 3), slightly curved and rounded off at each end; size 0·6 by 0·022 mm. (*b*) *Microsclera;* (1) small sigmata, size 0·019 by 0·0015, mm.; (2) very long, thin, hair-like spicules, apparently not arranged in bundles; size 0·7 by 0·003 mm.

Again we have only one specimen of the sponge present, and that possibly imperfect. As it comes from the same station and agrees in several particulars with *Gellius calyx* it is very likely a close ally of the latter; this hypothesis will be strengthened if the examination of more specimens shows that the fine hair-like spicules are also really proper to *Gellius calyx*. In the form of the oxeote spicules and the presence of hair-like ones, together with the sigmata, the species in question agrees pretty closely

[1] Sponges of the "Willem Barents" Expedition, 1880 and 1881, p. 29, pl. iv. figs. 18, 19; pl. v. figs. 87–90.

with Carter's *Fibularia massa*,[1] which is possibly also a *Gellius*. The hair-like spicules in our sponge are, however, much longer than in *Fibularia massa*, and in the latter they appear to originate in trichite bundles.

Locality.—Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; off the mouth of the Rio de la Plata; depth, 600 fathoms; bottom, green sand; bottom temperature, 37°·2. One specimen.

Genus *Gelliodes*, Ridley (Pls. X., XII., XLVII.).

1884. *Gelliodes*, Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., p. 426.

A distinct and well-developed skeleton fibre is present, containing more or less spongin. Microsclera sigmata.

Ridley's original diagnosis runs—"Desmacidinidæ of erect habit and well-defined form, fibre distinct and compact; outer surface of sponge beset with pointed eminences. Spicules smooth; skeleton acerate and bihamate."

This diagnosis must now be enlarged, in order to admit *Gelliodes lichenïformis*, Lamarck, sp., and *Gelliodes poculum*, nobis, and, omitting all description of external form, we may say that the genus differs from *Gellius* merely in the possession of a distinct and well-developed fibre with more or less horny matter, and from *Toxochalina* in the presence of sigmata in the place of toxa as microsclera. It is perhaps doubtful whether the last character is of generic value, and whether *Toxochalina* and *Gelliodes* should not be merged in one genus, but as no species is yet known whose spicular complement comprises both toxa and sigmata, they may at present be kept apart.

Gelliodes fibulata, Ridley (Pl. XII. fig. 2).

1813. ? *Spongia rubispina*, Lamarck, Ann. Mus. Hist. Nat. Paris, vol. xx. p. 450.
1881. ? *Axos fibulata*, Carter, Ann. and Mag. Nat. Hist., ser. 5, vol. vii. p. 383, pl. xviii. fig. 4.
1884. *Gelliodes fibulata*, Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., p. 427, pl. xxxix. fig. 1; pl. xli. figs. *bb–bb″*.

The Challenger obtained four good specimens of this sponge in Torres Strait, where also it was obtained abundantly by the "Alert." It is not necessary to redescribe the species here, but we give a figure of one very beautiful specimen, illustrating how the spines on the surface may bear secondary smaller spines, a feature which appears to have been overlooked hitherto (*vide* Pl. XII. fig. 2).

Locality.—Cape York, Torres Strait, August 7; 1874; depth, 3 to 11 fathoms. Four specimens.

Habitat.—? Bass Strait (Carter). Torres Strait ("Alert" and Challenger).

[1] *Ann. and Mag. Nat. Hist.*, ser. 5, vol. ix. p. 282.

Gelliodes licheniformis, Lamarck, sp. (Pl. XII. fig. 3; Pl. XLVII. figs. 1, 1*a*).

1813. *Spongia licheniformis, pars*, Lamarck, Ann. Mus. Hist. Nat. Paris, vol. xx. p. 371.
1836. *Spongia licheniformis*, Lamarck, Hist. Anim. sans Vert., t. ii. p. 543.

To this species we refer a single, encrusting, very lichen-like specimen from Station "135 (?) 60 fathoms." The Challenger specimen differs from the type (as evidenced by a dry specimen in the British Museum, in the series of Lamarckian sponges), in having slightly larger sigmata and a more slender fibre; in its present condition the surface is also more even, but no doubt this is in part due to the fact that the specimen is preserved in spirit. As so little is known of the species we may add a few details derived from an examination of the Challenger specimen.

Sponge (Pl. XII. fig. 3) sessile, encrusting. *Colour* in spirit light yellowish-brown. *Texture* (in spirit) soft, spongy, very fibrous. *Surface* uneven. *Dermal membrane* very thin and transparent. *Pores* small, scattered. *Oscula?*

Skeleton.—A not very regular reticulation of strongly developed, very distinctly lamellated, horny fibre cored by oxeote spicules, and of oxeote spicules united together by more or less horny substance (spongin). In addition to the main skeleton thus constituted there is a very well-developed and beautiful dermal reticulation (Pl. XLVII. figs. 1, 1*a*) of spiculo-fibre, consisting of a unispicular network of oxeote spicules with a very large proportion of spongin; backed up behind by a network of much stouter spiculo-fibre, with very few spicules and still more spongin.

Spicules.—(*a*) *Megasclera;* of one kind only, viz., straight, smooth oxea, measuring about 0·23 by 0·0096 mm. (*b*) *Microsclera;* of one kind only, viz., smooth, slender sigmata, usually measuring about 0·032 mm. in length, very rarely up to about 0·09 mm; thickness about 0·0012 mm.

The Challenger specimen might readily be mistaken for a young form of *Gelliodes poculum*, nobis, but this idea is precluded by the different character of the dermal skeleton. There is no doubt that Lamarck's *Spongia licheniformis* includes more than one species, both as shown by the specimens in the British Museum and by his own statement (*loc. cit.*):—"Habite dans differentes mers, et offre beaucoup de variétés." Our specimen agrees sufficiently closely with that in the British Museum to be ranked in the same species with it, but regarding Lamarck's other varieties we are not able to speak with certainty.

Gelliodes poculum, Ridley and Dendy (Pl. X.).

1886. *Gelliodes poculum*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 334.

Sponge (Pl. X.) consisting of a thin, spreading lamina, which, in the case of the Challenger example, grows over a large, massive Tetractinellid sponge; from this

spreading lamina arise large funnel-shaped calices with wide mouths. The basal lamina, in the case of the single specimen in the collection, covers a large, but very uneven surface; it averages about 4 mm. in thickness; this is also the thickness of the walls of the calices. The specimen bears in all five calices of various sizes, the largest measuring about 50 mm. in height, and 25 to 62 mm. in greatest width of mouth (which is compressed). *Colour* in spirit brownish-yellow. *Texture* soft, spongy, but very tough and fibrous. *Surface* very uneven but fairly smooth. More or less numerous, very small openings on the inside of the calices appear to be the true *oscula*.

Skeleton.—(*a*) *Main;* a reticulation of stout horny fibre, cored sparsely by oxeote spicules arranged uniserially. (*b*) *Dermal;* a similar but much closer reticulation of stout horny fibre, with very few axial spicules, but echinated very abundantly by tufts of oxea which project outwards.

Spicules.—(*a*) *Megasclera;* short, fusiform oxea, usually slightly curved, sharply and gradually pointed, measuring about 0·2 by 0·014 mm. (*b*) *Microsclera;* rather large and slender, much curved sigmata, not very abundant, measuring about 0·12 by 0·004 mm.

This interesting species is distinguished chiefly by its remarkable external form. It resembles a Chalinine sponge, described by Ridley under the name *Tuba* (*Siphonochalina*) *bullata*,[1] but is distinguished as regards external appearance by the absence of the numerous sharp conuli on the surface, and microscopically, of course, by the presence of the sigmata. Dr. R. von Lendenfeld also obtained a specimen of *Gelliodes poculum* from the east coast of Australia.

Locality.—Port Jackson, 30 to 35 fathoms. One specimen.

Genus *Toxochalina*, Ridley.

1884. *Toxochalina*, Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., p. 402.

A distinct, rectangularly arranged horny fibre present, cored by oxeote spicules, as in typical Chalininæ. Microsclera toxa.

Ridley's original diagnosis runs "Chalinidæ with well-developed horny fibre arranged rectangularly. Spicules, a skeleton acerate and a tricurvate acerate ('Bogen,' German) flesh-spicule."

Having regard to the close relationship of this genus to *Gelliodes* as indicated by the presence of the toxa, in conjunction with a distinct horny fibre, we have decided to remove it from amongst the "Chalininæ" and place it in the "Gelliinæ," amongst the Heterorrhaphidæ. It has appeared to us preferable throughout to classify rather by the presence or absence and the form of the microsclera than by the greater or less amount of spongin present.

[1] Zool. Coll. H.M.S. "Alert," Brit. Mus., 1884, p. 399, pl. xxxix. fig. c.

Toxochalina robusta, Ridley.

1884. *Toxochalina robusta*, Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., 1884, p. 403, pl. xxxix. fig. G; pl. xli. figs. *n*, *n'*.

We identify with this species a single small, irregularly branched specimen from Bahia, which agrees very closely in microscopical structure, though of not nearly such robust growth as the type. It may be only a young specimen.

Locality.—Off Bahia, 7 to 20 fathoms. One specimen.

Habitat.—Port Jackson (Ridley, "Alert"); off Bahia (Challenger).

Subfamily 3. Tedaniinæ.

1886. *Tedaniina*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 335.

Megasclera always of two forms:—(1) *Monactinal*, styli, forming the main skeleton; (2) *Diactinal*, tylota or tornota, dermal. Microsclera always present in the form of rhaphides.

Two genera of this subfamily are distinguished, viz., *Tedania*, in which the stylus is smooth, and *Trachytedania*, in which it is more or less spined. In both genera the form is usually massive, amorphous, and both genera are characteristically shallow-water forms. The dermal spicules are susceptible of very great variation in the different species, being sometimes bicapitate (tylota), and at other times hastately pointed (tornota).

Genus *Tedania*, Gray (Pls. XI., XXIII., XXIX.).

1862. *Reniera, pars*, Schmidt, Spong. Adriat. Meer., p. 75, &c.
1867. *Tedania*, Gray, Proc. Zool. Soc. Lond., May 9, p. 520.

Styli smooth.

Gray's original diagnosis runs—"Sponge lobed, crested, with a lateral tube ending in an open mouth. Spicules of three kinds:—1. Clavate, needle-shaped. 2. Fusiform, very slender, elongate, sometimes flexuous. 3. Cylindrical, with rather thicker, blunt ends."

The range of external form exhibited by this genus is shown by the Challenger dredgings to be a very remarkable one indeed; hitherto known only by more or less massive or digitate specimens, we have had to add to the genus two new species, *Tedania infundibuliformis* and *Tedania actiniiformis*, characterised by very specialised, though quite different, external forms; the former (as yet known by only one specimen) being funnel-shaped, and the latter "actiniiform,"[1] with oscular projections on the top and a definite zone of pores.

[1] Like an *Actinia*.

The species of this genus are very difficult to separate satisfactorily from one another; future researches may, very probably, by the discovery of intermediate forms, render possible the union of some which are at present described as distinct.

Tedania digitata, Schmidt (Pl. XI. fig. 3).

1862. *Reniera digitata*, Schmidt, Spong. Adriat. Meer., p. 75, Pl. vii. fig. 11.
1864. „ *ambigua*, Schmidt, Spong. Adriat. Meer., Suppl., p. 39.
1867. *Tedania digitata* et *ambigua*, Gray, Proc. Zool. Soc. Lond., May 1867, p. 520.
1868. *Reniera muggiana*, Schmidt, Spong. d. Küste v. Algier., p. 28.

This widely distributed species has been sufficiently described by previous writers;[1] a number of specimens, varying in form from massive to digitate cylindrical (Pl. XI. fig. 3), were obtained by the Challenger, off Port Jackson.

Locality.—Off Port Jackson, 6 to 35 fathoms, several specimens, mostly rather fragmentary.

Habitat.—Mediterranean (Schmidt); Atlantic (Schmidt); Antigua (Carter); Mozambique, Marie Louise Island, Amirante Group (Ridley, "Alert"); Kurrachee (Coll. Brit. Mus.). Port Jackson (Challenger); Alert and Thursday Islands and Prince of Wales Channel, Torres Strait; Port Darwin (Ridley, "Alert").

Tedania digitata, var. *fibrosa*, nov.

A single rather large, massive specimen, distinguished from the type by the very slender spicules and the distinct primary fibre.

Spicules.—(1) Smooth styli, measuring about 0·18 by 0·005 mm.; (2) double headed cylindricals (tylota), with minutely spined heads, measuring about 0·21 by 0·0024 mm.; (3) very fine, scattered rhaphides.

Locality.—Off Port Jackson, 7 fathoms. One specimen.

Tedania digitata, var. *bermudensis*, nov.

A single small, massive specimen from Bermuda, of a pale yellow colour and with small scattered oscula. The skeleton is somewhat "*Isodictyal*" in arrangement but confused. The chief point of distinction concerns the styli, which are more slender than in either of the two preceding forms and appear to be blunted.

Locality.—Bermuda, West Indies. One specimen.

[1] *Vide supra*, also Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., 1884, pp. 417, 607.

Tedania tenuicapitata, Ridley (Pl. XI. fig. 5).

1881. *Tedania tenuicapitata*, Ridley, "Alert" Coll., Proc. Zool. Soc. Lond., January, p. 124, pl. xi. fig. 1.

This species has already been fully described (*loc. cit.*), it is, therefore, unnecessary to give much further description. The "Alert" obtained only a single specimen of the sponge while the Challenger obtained a considerable number.

The Challenger specimens show plainly that the usual form of the sponge is massive (Pl. XI. fig. 5). They also show a very considerable range of variation in the character of the ends of the tylota, which vary from a very elongate, slightly demarcate and acutely pointed form to a short, regularly defined head, rounded terminally;[1] the roughening of the fine rhaphides alluded to in the original description (*loc. cit.*) was made out in one specimen, but only in a spicule which was not adult. So great is the variation of the diactinal spicules and so nearly do they approximate the spiculation of this form to that of *Tedania suctoria*, Schmidt,[2] that it must be considered doubtful whether it is more than varietally distinct from it. As yet, however, the structures described as excretory papillæ by Schmidt (*loc. cit.*), have not been found here, and perhaps may prove distinctive.

Localities.—Station 308, January 5, 1876; lat. 50° 8′ 30″ S., long. 74° 41′ 0″ W.; south-west Patagonia; depth, 175 fathoms; bottom, blue mud. Several specimens.

Station 311, January 11, 1876; lat. 52° 45° 30″ S., long. 73° 46′ 0″ W.; off south-west Patagonia; depth, 245 fathoms; bottom, blue mud; bottom temperature, 46°·0. Several specimens.

Station 314, January 21, 1876; lat. 51° 35′ S., long. 65° 39′ W.; east of the Strait of Magellan; depth, 70 fathoms; bottom, sand; bottom temperature, 46°·0. One fine specimen (Pl. XI. fig. 5).

Habitat.—Off the south-west coast of Patagonia ("Alert," Challenger); between Strait of Magellan and Falkland Islands (Challenger).

Tedania commixta, Ridley and Dendy (Pl. XXIII. figs. 9, 9*a*, 9*b*, 9*c*).

1886. *Tedania commixta*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 335.

Sponge massive, amorphous. *Colour* in spirit creamy-yellow. *Texture* soft and compact, with a large admixture of foreign grit. *Surface* slightly corrugated. *Dermal membrane* thin but distinct. *Oscula* small, scattered, with their margins flush with the surface. *Pores* scattered (?).

Skeleton.—Consisting of very loose, whisp-like fibres, apparently without any definite

[1] The rounded heads of the tylota were observed only in one of the specimens, and even here a large number of these spicules have the heads pointed.

[2] Spong. Atlant. Gebiet., p. 43.

arrangement, running towards the surface, where they break up into divergent tufts of slender bicapitate cylindrical spicules (tylota).

Spicules.—(*a*) *Megasclera;* (1) long, slender, slightly curved, hastately pointed styli; measuring about 0·3 by 0·0042 mm. These spicules may approach the tylostylote form (Pl. XXIII. figs. 9, 9*a*); (2) long, slender tylota, with usually only slightly developed, oval heads; size about 0·35 by 0·004 mm. (Pl. XXIII. figs. 9*b*, 9*c*). (*b*) *Microsclera;* exceedingly fine, hair-like, scattered rhaphides, about 0·13 mm. long.

This species is represented in the collection by a thick triangular lump with square-cut edges, which appear to be natural; the upper surface is almost flat. The sponge, especially near the lower surface, contains large quantities of foreign bodies, sand, fragments of shells, &c. It is quite possible that here, as in other cases, the foreign bodies to a certain extent replace the proper skeleton of the sponge. The species is characterised by the presence of these foreign bodies, whence the specific name, and by the proportions of the megasclera and rhaphides, but it comes near to *Tedania tenuicapitata*, being distinguished from it chiefly by the rhaphides being only about half as long as in that species, and by the presence of the foreign bodies; hence it may perhaps have to be united with it at some future time.

Locality.—Station 162, April 2, 1874; lat. 39° 10′ 30″ S., long. 146° 37′ 0″ E.; Bass Strait; depth, 38 fathoms; bottom, sand and shells.

Tedania massa, Ridley and Dendy (Pl. XI. figs. 4, 4*a*; Pl. XXIII. figs. 2, 2*a*, 2*b*).

1886. *Tedania massa*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 335.

Sponge (Pl. XI. fig. 4) massive, flattened and cake-like, amorphous or lobose. Size apparently indefinitely great, the largest specimen measuring as much as 325 mm. long by 200 broad, and from 12 to 25 mm. thick; other specimens are as much as 50 mm. thick. *Colour* in spirit, grey, brown, or pale yellow. *Texture* very soft and spongy. *Surface* fairly even, very minutely hispid. *Dermal membrane* fairly distinct, with a reticulate appearance. *Oscula* more or less numerous, scattered, or in rows along the margins of the flattened lobes (Pl. XI. fig. 4, *o*), flush with the surface or with slightly raised margins; diameter about 4 mm. *Pores* scattered, but commonly in groups (Pl. XI. fig. 4*a*).

Skeleton.—Divisible into three parts:—(1) a very loose, isodictyal reticulation of large, stout, stylote spicules. (2) A loose reticulation, with very large meshes, of stout, compact fibres like bands of horse-hair, composed of very long, fine, flexible, oxeote rhaphides, with more or less admixture of the stylote and diactinal spicules. One can distinguish primary fibres running more or less vertically to the surface, and secondary fibres crossing these at right angles; but the arrangement is very irregular and the fibres run for long distances without being crossed by others. (3) On approaching the surface of the sponge both these kinds of skeleton give place to a reticulation of hastately pointed cylindricals

(tornota). These spicules form a network immediately below the dermal membrane, giving to the surface of the sponge a characteristic lace-like appearance, and great numbers of them also project from the surface in divergent brushes.

Spicules.—(*a*) *Megasclera;* (1) the large, stout, smooth styli (Pl. XXIII. fig. 2), confined almost exclusively to the deeper parts of the sponge; often rather strongly curved and somewhat hastately pointed at the apex, but with the point often blunted; size about 0·7 by 0·03 mm. (2) The dermal spicules (Pl. XXIII. figs. 2*a*, 2*b*); these are rather slender, straight, and sub-hastately but not very sharply pointed at each end; sometimes they have distinct, though small, heads, but very frequently the heads cannot be distinguished from the shaft. Size about 0·45 by 0·013 mm. (*b*) *Microsclera;* very numerous long, fine, oxeote rhaphides, up to about 0·8 mm. in length; often collected into fibres as above stated, but also found abundantly scattered about in the soft tissues of the sponge (? due to displacement and breaking up in cutting sections), and in the dermal membrane. They often exhibit a roughening of the surface similar to that remarked on in the corresponding spicules of *Tedania tenuicapitata.*

This species was obtained by the Challenger in great quantities off the mouth of the Rio de la Plata and the eastern end of the Strait of Magellan. In the form of the diactinal megasclera it comes near to *Tedania tenuicapitata*, Ridley, but it may be readily recognised by the arrangement of the skeleton, the size and shape of the styli, and the lace-like appearance of the surface.

The most remarkable feature of the species is the enormous size to which it attains. Judging from the quantity brought home from Station 320, we must imagine it in that locality coating portions of the sea-bottom in great spreading sheets.

Localities.—Station 163D, June 12, 1874; lat. 33° 57′ 30″ S., long. 151° 39′ 15″ E.; depth, 120 fathoms; bottom, green sand. One small, dark-coloured specimen, which has apparently been taken from a crab's back, and seems to be referable to this species.

Station 313, January 20, 1876; lat. 52° 20′ S., long. 67° 39′ W.; east of the Strait of Magellan; depth, 55 fathoms; bottom, sand; bottom temperature, 47°·8. Several fair-sized pieces.

Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; off the mouth of the Rio de la Plata; depth, 600 fathoms; bottom, green sand; bottom temperature, 37°·2. A large quantity; some specimens of very large size.

Tedania infundibuliformis, Ridley and Dendy (Pl. XI. fig. 1; Pl. XXIX. figs. 2, 2*a*).

1886. *Tedania infundibuliformis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 335.

Sponge (Pl. XI. fig. 1) erect, lamellar, funnel-shaped.[1] The single specimen present consists of a deep hollow cup, slightly compressed, so as to have an oval section, and

[1] This, as in *Phakellia ventilabrum*, is very possibly not a constant character of the species.

with moderately thick walls; it has been broken off at the bottom, so that the nature of the base cannot be determined. Height 72 mm.; greatest breadth across the mouth about 50 mm.; thickness of walls about 6 mm., thinning towards the lip. *Colour* in spirit pale yellow. *Texture* soft and very fragile. *Surface* (the specimen is so much washed that it is difficult to determine the true nature of the surface, but it seems to have been fairly smooth both inside and out). *Dermal membrane;* for the most part washed off; thin and transparent. *Oscula* small, scattered over the inside of the cup (? only). *Pores?*

Skeleton.—A very loose, slightly fibrous reticulation of rather slender stylote spicules, with bicapitate cylindricals (tylota) rather sparingly arranged at the surface, in irregular tufts or scattered.

Spicules.—(*a*) *Megasclera;* (1) slightly curved or straight, slender, smooth styli (Pl. XXIX. fig. 2), sharply and rather suddenly pointed at the apex; size about 0·54 by 0·015 mm.; (2) slender, smooth, straight tylota (Pl. XXIX. fig. 2*a*), much smaller than the styli, with well-developed oval heads often somewhat pointed at the ends, and (?) with slight traces of minute spination. Size about 0·28 by 0·0063 mm. (*b*) *Microsclera;* very abundant, long, hair-like rhaphides, very slender, and scattered through the tissues like hair in plaster; occurring both separately and in loose bundles; size about 0·35 by 0·002 mm.

Had not this species differed somewhat in spiculation, as well as in external form, from those previously described, we should scarcely have ventured to describe it as new; unfortunately there is only a single specimen in the collection; as regards spiculation the most characteristic feature is the form of the bicapitate cylindricals (tylota) (Pl. XXIX. fig. 2*a*); the rhaphides are remarkably large, though not coming up to those of *Tedania massa*.

Locality.—Off the south-west coast of Patagonia. One specimen.

Tedania actiniiformis, Ridley and Dendy (Pl. XI. figs. 2, 2*a*; Pl. XXIX. figs. 1, 1*a*).

1886. *Tedania actiniiformis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 336.

Sponge (Pl. XI. fig. 2) sessile, cylindrical, shape like that of a sea-anemone (whence the specific name) attached by a narrowed base to a fragment of stone; abruptly and flatly truncated above so as to give rise to a broad oval plateau which bears four or five small oscular tubes. On the side of the sponge at a distance of about 2 mm. below the top is a circular zone of pores, about 2 mm. in breadth, running round the sponge (*vide* fig.). Height of sponge 18 mm.; greatest diameter at top 29 mm., at base 18 mm. *Colour* in spirit greyish-brown. *Texture* soft and spongy (the specimen is in bad condition). *Surface* rather uneven. *Dermal membrane* thin and transparent. *Oscula*

few, rather small, on the summits of small oscular tubes at the top of the sponge. *Pores*, observed only in the well-defined "pore-zone" above mentioned, here they are very abundant (Pl. XI. fig. 2*a*).

Skeleton.—The main skeleton is extremely diffuse and irregular, consisting of an almost unispicular reticulation of stylote spicules with no definite spiculo-fibre. Below the pore-zone there is an irregular dermal reticulation of thickly scattered stylote and tornote spicules. In the pore-zone itself one finds the stylote spicules absent from the dermal membrane, and the tornota coming to the surface in thick brushes. Above the pore-zone comes a low wall of thickly packed, and for the most part vertically disposed tornota (lying parallel with the surface), terminating above flush with the top of the sponge.[1] On the top itself the dermal reticulation is of the same character as below the pore-zone (*i.e.*, irregular).

Spicules.—(*a*) *Megasclera;* (1) stout, smooth, slightly curved, rather bluntly pointed styli (Pl. XXIX. fig. 1), measuring about 0·87 by 0·03 mm., forming the main skeleton and occurring also in the dermal reticulation; (2) straight, smooth, slightly fusiform, hastately pointed cylindricals (tornota) (Pl. XXIX. fig. 1*a*) with rather peculiarly shaped points, size about 0·56 by 0·019 mm., occurring, as usual, at or near the surface. (*b*) *Microsclera;* long, straight, oxeote rhaphides, size about 0·56 by 0·0031 mm., commonly in whisp-like bundles. It seems to us not at all impossible that the rhaphides in this and in other species of *Tedania* may be in reality only young oxeote (tornote) megasclera; certain it is that they are very different from the "trichodragmata" such as occur in *Esperella murrayi*, &c.

This is a very important and well-characterised species; it is distinguished from all previously known by its external form and the arrangement of the pores in a definite zone. Its stylote spicule is the largest in the genus. It affords a really splendid instance of the manner in which sponges, which are shapeless masses when occurring in shallow water, assume in abyssal depths (in this case 2160 fathoms) a definite, symmetrical external form; this is its chief interest, for the species of the genus hitherto known, from comparatively shallow water, are, *par excellence*, amorphous sponges.[2]

Unfortunately there is only one specimen in the collection and that in bad condition, so that we are unable to give any details as to the minute anatomy.

Locality.—Station 299, December 14, 1875; lat. 33° 31′ S., long. 74° 43′ W.; west of Valparaiso; depth, 2160 fathoms; bottom, blue mud; bottom temperature, 35°·2. One specimen.

[1] This arrangement gives rise to a faint vertical striation on the surface of the sponge above the pore-zone (*vide* fig. 2). It is also present to a less extent just below the pore-zone.

[2] We must make an exception to this statement in the case of *Tedania infundibuliformis*, nobis, while *Tedania massa*, nobis, is an amorphous form ranging down to 600 fathoms.

Genus *Trachytedania*, Ridley (Pl. XXIII.).

1881. *Trachytedania*, Ridley, Proc. Zool. Soc. Lond., January 4, 1881, p. 122.

Styli, in part or all, spined.

The first species of the genus was obtained by the "Alert" in Portland Bay, Chili; in it the characteristic spination of the stylote spicule, which distinguishes this genus from the closely allied genus *Tedania*, is only very faintly marked. The Challenger adds one new species, from off the south-west coast of Patagonia, in which the spination of the stylus is very strongly marked; it is, however, an open question whether this character is in itself sufficient to separate the two genera; Vosmaer,[1] however, accepts the genus *Trachytedania* as distinct. We have found it advisable to make some alterations in the generic diagnosis.

Trachytedania patagonica, Ridley and Dendy (Pl. XXIII. figs. 6, 6*a*, 6*b*, 6*c*).

1886. *Trachytedania patagonica*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 336.

Sponge represented by two small, irregularly shaped specimens; massive, amorphous. Length of largest fragment about 37 mm. *Colour* in spirit pale yellow. *Texture* soft and crumbling. *Surface* uneven, with slight traces of hispidation. *Dermal membrane* thin but distinct. *Oscula* (?) small, scattered. *Pores* scattered; in some parts of the dermal membrane almost or entirely wanting, in other parts fairly abundant.

Skeleton.—Very loose and irregular, consisting of a somewhat "Isodictyal" reticulation of spicules, chiefly of spined styli, but with a small admixture of oxea (tornota). No distinct fibre. Immediately beneath the dermal membrane are a number of irregular, divergent tufts of oxeote (tornote) spicules, while similar spicules are scattered through the dermal membrane itself, forming, together with some of the stylote spicules, a very sparse and irregular dermal reticulation.

Spicules.—(*a*) *Megasclera;* of two kinds—(1) Rather stout, slightly curved, spined styli (Pl. XXIII. figs. 6, 6*a*, 6*b*); spined all over, except perhaps at the extreme apex; but with the spination most marked at the base; size about 0·35 by 0·0125 mm. (2) Straight, short oxea (tornota) (Pl. XXIII. fig. 6*c*), stoutest towards the centre and tapering gradually to a slightly hastate point at each end; size about 0·245 by 0·007 mm. Both the form of these spicules and their position in the sponge show that they are homologous with the "bicapitate cylindricals" (tylota) in the typical *Tedaniæ*, and with the corresponding "cylindricals" of *Trachytedania spinata*, Ridley.[2] (*b*) *Microsclera;* very fine, scattered, oxeote rhaphides, slightly thicker at one end than at the other; length about 0·2 mm., often (? always) spined near the broader end with fine spines directed towards that end of the spicule.

[1] Porifera, Bronn's Klass. u. Ordn. d. Thierreichs, p. 340.

[2] *Proc. Zool. Soc. Lond.*, January 4, 1881, p. 123.

The species is distinguished from *Trachytedania spinata*, Ridley, the only species hitherto known, by the superior dimensions of all the spicules, by the distribution of the spines practically all over the stylote spicules, and by the fine spination of most of the rhaphides.

Localities.—Station 308, January 5, 1876; lat. 50° 8′ 30″ S., long. 74° 41′ 0″ W.; off the south-west coast of Patagonia; depth, 175 fathoms; bottom, blue mud. One small specimen.

Station 308 (?) or 311 (?), off the south-west coast of Patagonia. The larger specimen.

Subfamily 4. Desmacellinæ.

1886. *Desmacellina*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 336.

Megasclera all monactinal, stylote to tylostylote. Microsclera sigmata or toxa or both.

Genus *Desmacella*, Schmidt.

1870. *Desmacella*, Schmidt, Spong. Atlant. Gebiet., p. 53.
1870. *? Desmacodes*, Schmidt, Spong. Atlant. Gebiet., p. 54.

This being the sole genus of the subfamily the diagnosis is the same.

Schmidt's original diagnosis (*loc. cit.*) runs thus:—"Spongien, welcher ausser den gestreckten einfachen Nadeln nur Bogen oder Spangen besitzen. Die Nadeln entweder in undeutlichen Zügen oder faserig geschichtet." With regard to *Desmacodes* he states (*loc. cit.*) of *Desmacodes subereus*, the type of the genus, that it unites the habit of *Papillina suberea* with the spicules of *Desmacella*, and describes the spicules as "Spindelnadeln," "Stifte," "Stecknadeln" and "Spangen," but his description is very scanty.

Vosmær[1] limits the name *Desmacella* to species with diancistra or "trenchant bihamate" spicules (*Vomerula* of this Report, &c.), but subsequently[2] places these under *Hamacantha*, Gray, stating that *Desmacella pumilio* and *Desmacella vagabunda* of Schmidt, the types of the genus *Desmacella*, could easily be referred to *Desmacodes* (although he proceeds inconsistently to place *Desmacella vagabunda* under *Gellius* directly afterwards). But the name *Desmacella* has the advantage of priority over *Desmacodes;* and therefore, while we agree with Vosmær in keeping this little group of species distinct from *Gellius* and its allies on the one hand and *Vomerula* and its allies on the other, we retain the name originally conferred upon them.

Desmacellæ are not commonly met with. A species is described by Carter in the "Porcupine" Report as *Desmacella pumilio* of Schmidt, but as yet very little is known about the group.

[1] The Family of the Desmacidinidæ, Notes from the Leyden Museum, vol. ii. p. 109.
[2] Sponges of the "Willem Barents" Expedition, 1880–81, p. 28.

Desmacella annexa, Schmidt.

1870. *Desmacella vagabunda*, var. *annexa*, Schmidt, Spong. Atlant. Gebiet., p. 53.
1874. *Desmacella pumilio*, Carter, Ann. and Mag. Nat. Hist., ser. 4, vol. xiv. p. 250.
1880. *Desmacodes vagabundus*, var. *annexa*, Vosmaer, Notes from the Leyden Museum, vol. ii. p. 108.

With this species we identify a small fragment from Station 24. The most characteristic feature of the species is the presence of numerous very fine toxa, measuring 0·09 by 0·001 mm. These toxa also occur in Schmidt's type specimen, as attested by a preparation in the British Museum, although Schmidt and Vosmaer both refer to them simply as "acerates."

The identification of Mr. Carter's species was made after a comparison of his account with the slides representing Schmidt's species in the British Museum.

Locality.—Station 24, March 25, 1873; lat. 18° 38′ 30″ N., long. 65° 5′ 30″ W.; West Indies; depth, 390 fathoms; bottom, Pteropod ooze.

Habitat.—Florida (Schmidt); English Channel (Carter); West Indies (Challenger).

Subfamily 5. Hamacanthinæ.

1872. *Hamacanthidæ*, Gray, Ann. and Mag. Nat. Hist., ser. 4, vol. ix. p. 449.
1886. *Vomerulinæ*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 337.

Megasclera oxea or styli. Microsclera large diancistra, to which others may be added.

We propose to recognise in this subfamily two genera, according as the megasclera are oxeote (ranging to strongylote) or stylote. In the one genus, *Hamacantha*, Gray,[1] the only species yet known to us is Bowerbank's *Hymedesmia johnsoni*,[2] a species which appears to have been never yet described, although Dr. Bowerbank figures the characteristic diancistra (*loc. cit.*). Examination of the preparations in the British Museum has shown us that the megasclera are oxeote. The second genus is *Vomerula*, Schmidt, in which the megasclera are stylote.

Unfortunately the genus *Hamacantha* is not represented in the Challenger collection.

Genus *Vomerula*, Schmidt (Pls. XII., XVII.).

1874. *Halichondria*, *pars*, Bowerbank, Mon. Brit. Spong., vol. iii. p. 208.
1880. *Vomerula*, Schmidt, Spong. Meerb. von Mex., p. 82.
1885. *Hamacantha*, *pars*, Vosmaer, Sponges of the "Willem Barents" Expedition, 1880–81, p. 28 (*sep*); *nec id.*, Bronn's Klass. u. Ordn. d. Thierreichs, Porifera, p. 352, *nec* Gray, Proc. Zool. Soc. Lond., 1867, p. 538.

Megasclera styli.

This genus has been wrongly characterised by Vosmaer as distinguished by the

[1] *Proc. Zool. Soc. Lond.*, 1867, p. 538.

[2] *Vide* Mon. Brit. Spong., vol. i. figs. 112, 293.

presence of "anchorate" microsclera (chelæ),[1] while Schmidt's typical species of the genus, *Vomerula tenda*,[2] does not possess these; on the other hand, the genus differs from *Hamacantha*, Gray, in a point unnoticed by Vosmaer, viz., the possession of well-marked stylote megasclera, and on this account the two genera *Hamacantha* and *Vomerula* may at present remain separate. This difference is, however, perhaps not so important as would at first sight appear, as the so-called oxeote of *Hamacantha johnsoni* is frequently slightly blunted at one (or both) ends, and therefore seems to be possibly derived from a stylote spicule or to have given rise to that of *Vomerula;* (this tendency to bluntness is indicated, but perhaps too strongly, in Bowerbank's original figure).[3] On the other hand, there is one preparation in the Bowerbank collection, from a species identified by him with *Hamacantha johnsoni*, in which the oxeote spicules are well pointed at both ends, with no noticeable tendency to blunting. This greatly supports us in distinguishing two genera of the subfamily.

Vomerula esperioides, Ridley and Dendy (Pl. XII. fig. 1; Pl. XVII. figs. 2, 4, 12).

1886. *Vomerula esperioides*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 337.

Sponge (Pl. XII. fig. 1) large, erect, forming tall, thick, leaf-like expansions, attached by the base, reaching about 250 mm. in height by about 50 mm. or more in breadth and 25 mm. in thickness. *Colour* in spirit pale yellow. *Texture* tough and strong, owing to the very coarse fibres of the skeleton; but the interior is cavernous. *Surface* uneven, with numerous small prominences (conuli) caused by the projecting ends of the underlying fibres of the skeleton. Supported upon, and stretched tightly between these prominences is a thin transparent *dermal membrane*, covering over the large, irregular, subdermal cavities. The dermal membrane (Pl. XVII. fig. 12) contains very numerous round *pores*, 0·07 mm. in diameter, which lead from the exterior into the subdermal cavities; the boundaries of these pores are supported by numerous small sigmata arranged around them. The dermal membrane is further supported by a reticulation of fine fibres, yet easily visible to the naked eye, which gives a highly characteristic appearance to the surface. The *oscula* are placed on the summits of small, conical, bladder-like papillæ (Pl. XII. fig. 1), bounded only by the dermal membrane, in which there are here no pores. Over these papillæ the dermal reticulation of fine fibres is absent and its place is taken by a single layer of closely placed spicules, in which the styli are mostly arranged longitudinally and more or less parallel with one another.

[1] Bronn's Klass u. Ordn. d. Thierreichs, Porifera, p. 352.
[2] Spong. Meerb. von Mex., 1880, p. 82.
[3] Mon. Brit. Spong., vol. i. pl. xviii. fig. 293.

Skeleton.—(*a*) *Dermal;* a reticulation of spiculo-fibre (Pl. XVII. fig. 12) varying from one to nine or ten spicules in breadth, and composed of stylote spicules. Over the osculum-bearing papillæ this reticulation is replaced by a single dense layer of closely packed stylote spicules, mainly placed longitudinally and more or less parallel with one another. (*b*) *Main;* composed of a coarse reticulation of thick, stout spiculo-fibre, composed of stylote spicules like those of the dermal skeleton, but usually a little shorter.

Spicules.—(*a*) *Megasclera;* smooth styli (Pl. XVII. fig. 4) tapering to a not very sharp point at the apex and also slightly towards the base, measuring about 0·7 by 0·019 mm. (*b*) *Microsclera;* two kinds are present—(1) numerous large, contort diancistra, measuring 0·177 mm. long by 0·019 mm. in breadth of shaft. The exact shape of these spicules will be best understood from the figure (Pl. XVII. fig. 2, *a*, *b*). They occur both in the deeper tissues and in the dermal layer. (2) Very numerous, small, contort spicules, many of which appear to be young forms of the large diancistra (Pl. XVII. fig. 2, *d*), while others (Pl. XVII. fig. 2, *c*), different in form, are certainly not so; length of the latter 0·038 mm., and of the former about the same. The latter are simply sigmata. Both forms occur abundantly in the dermal membrane as well as in the deeper tissues. In the dermal membrane they are so arranged as to leave frequent spaces in which the pores are situated.

In its very distinct and lace-like dermal membrane, strong, fibrous skeleton and general external appearance, this sponge closely resembles many *Esperellæ*, whence the specific name. For a *Vomerula* it is very large. The large diancistra are like those of *Hamacantha* (*Hymedesmia*) *johnsoni*, Bowerbank.[1] *Hamacantha papillata*, Vosmaer,[2] from the Arctic Seas, differs from *Vomerula esperioides* chiefly in the presence of cylindrical spicules (*tr.*[2]), but has the papillæ.

The sponge seems to grow in a very luxuriant manner on the Agulhas Bank, many fine specimens having been obtained by the Challenger from that locality.

Localities.—Station 142, December 18, 1873; lat. 35° 4′ S., long. 18° 37′ W.; Agulhas Bank; depth, 150 fathoms; bottom, green sand; bottom temperature, 47°·0. Two large bottles full.

Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; off the mouth of the Rio de la Plata; depth, 600 fathoms; bottom, green sand; bottom temperature, 37°·2. A small fragment of a dark greenish colour, which, in accordance with its spiculation, we identify with this species.

[1] Mon. Brit. Spong., vol. i. pl. v. fig. 112.

[2] Sponges of the "Willem Barents" Expedition, 1880–81, p. 28 (*sep.*).

Family III. Desmacidonidæ.

Megasclera of various forms, usually monactinal. Microsclera always present and always including chelæ.[1]

Subfamily 1. Esperellinæ.

1886. *Esperina*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 337.

Skeleton fibre not echinated by laterally projecting spicules.

Genus *Esperella*, Vosmaer (Pls. XIII., XIV., XV., XVI.).

1833. *Esperia*, Nardo, Isis, p. 522.
1869. *Raphioderma*, Norman, Brit. Assoc. Rep. for 1868, p. 333.
1874. *Raphiodesma*, Bowerbank, Mon. Brit. Spong., vol. iii. pp. 94, 235.
1885. *Esperella*, Vosmaer, Bronn's Klass. u. Ordn. d. Thierreichs, Porifera, p. 353.

Shape various, amorphous or symmetrical. Megasclera all monactinal, usually styli, but sometimes with slightly developed, oval heads; smooth. Microsclera palmate anisochelæ, to which may be added either sigmata, trichodragmata, small isochelæ[2] or toxa, or combinations of these. Fibre usually distinct, branching and anastomosing, often containing much spongin.

The name *Esperia*, which has so long been in use for this genus, was altered by Vosmaer (*loc. cit.*), to *Esperella*, because he found that it had already been given to a genus of Lepidopterous Insects.

Many species of the genus *Esperella* attain a high degree of complexity both as regards spiculation and the arrangement of the soft parts; a very characteristic feature, though it perhaps hardly deserves a place in a generic diagnosis, is the breaking up of the main fibres of the skeleton as they approach the surface of the sponge into brushes of separate spicules which support the dermal membrane.

The canal system is usually very complex and the pores are sometimes collected into definite "pore-areas," although they may at the same time occur scattered on other parts of the sponge.

The Challenger dredgings have brought to light several very remarkable species of this genus, but by far the most remarkable is the one which we have called *Esperella biserialis*, obtained at two stations in the South Pacific at depths of 2385 and 2250 fathoms respectively. This species has the external form of a *Cladorrhiza*, but with a distinctly bilateral symmetry; while the anisochelate microsclera, though exceedingly

[1] We have included one or two species without chelæ on the supposition that they have had them and subsequently lost them.

[2] Very possibly only young forms of the anisochelæ, *vide* Carter, *Ann. and Mag. Nat. Hist.*, ser. 4, vol. xiv. p. 102.

minute, are of the *Esperella* type. It affords a striking example of the way in which Monaxonid sponges from very deep water tend to assume a definite, symmetrical external form.

Esperella mammiformis, Ridley and Dendy (Pl. XIV. figs. 5, 6; Pl. XV. figs. 1, 18, 18*a*).

1886. *Esperella mammiformis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 337.

Sponge (Pl. XIV. figs. 5, 6) sessile, hemispherical, usually with flat base, by which it is attached to stones, and a slight, free, projecting rim all round. At the top are one or two (usually only one) short, slender projections, bearing the oscula at their summits. *Size* 17 mm. in diameter across the base. *Colour* in spirit pale greyish-yellow. *Texture* soft and stringy. *Surface* even, but rather rough owing to the presence of numerous foreign bodies, Foraminifera, &c. *Dermal membrane* thin, transparent. *Pores;* a few only have been found, here and there, about 0·04 mm. in diameter. *Oscula*, usually one only, at the summit of a short tubular projection (Pl. XIV. figs. 5, 6, *o*). One specimen had two such oscula.

Skeleton.—(*a*) *Dermal;* a reticulation of loose spiculo-fibre, composed of long stylote spicules. (*b*) *Main;* this is arranged in a radiate manner; starting from the centre of the circular base, fibres radiate in every direction except downwards. The base itself thus acquires a stellate appearance, having a number of bands of spiculo-fibre radiating from its centre to its circumference like the spokes of a wheel. Other fibres radiate from the same point to every part of the surface of the sponge; as they approach the surface each breaks up into a brush of divergent spicules, which spread out and terminate in the dermal layer, to which they give support (*cf.* the similar arrangement in *Esperella murrayi*). In addition to the fibres just described there appear to be some poorly-developed secondary fibres which cross the main ones more or less at right angles.

Spicules.—(*a*) *Megasclera;* of one kind only, viz., long, smooth, slender styli (Pl. XV. fig. 1), sometimes showing a tendency to develop heads, as in so many *Esperellæ;* usually quite straight and tapering gradually to a very fine point; size about 1 mm. by 0·019 mm. The spicule also tapers a little towards the base. (*b*) *Microsclera;* of one kind only, viz., palmate anisochelæ, with the front palm much rounded; length of spicule 0·072 mm.; breadth of large end 0·034 mm. The shape of these spicules is very characteristic (*vide* Pl. XV. figs. 18, 18*a*); smaller ones also occur, probably young forms of the larger.

This is a very beautiful little species and affords another good example of a deep-sea sponge with a definite external form. It is distinguished by the external form, the

arrangement of the skeleton, the shape of the spicules, and the presence of only one kind of microsclera, the last being a very remarkable point. *Esperia stolonifera*, Merejkowsky, from the White Sea,[1] has a very similar spiculation, the stylus being, as here, not tylote, but the anisochela is much narrower in that species than in *Esperella mammiformis* and only about half the length. Lying in the soft tissues at the bases of the specimens were a number of small, round, or sometimes hemispherical embryos, which will be found described in the Introduction.

It is noteworthy that the soft parts of the sponge contained a large number of foreign bodies, such as Diatoms, &c.

It appears that the sponge may sometimes live free on the sea-bottom, the base being in these cases "pinched up" (as represented on Pl. XIV. fig. 5) instead of flat and expanded; or possibly the sponge may have been attached to a very small object.

Locality.—Station 147, December 30, 1873; lat. 46° 16′ S., long. 48° 27′ E.; east of Prince Edward Island; depth, 1600 fathoms; bottom, Diatom ooze; bottom temperature, 34°·2. Six specimens, mostly much damaged.

Esperella lapidiformis, Ridley and Dendy (Pl. XV. figs. 2, 10, 10*a*; Pl. XVI. figs. 2, 2*a*, 2*b*).

1886. *Esperella lapidiformis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 338.

Sponge (Pl. XVI. fig. 2) massive, squarish, with rounded corners; resembling nothing so much as a water-worn boulder, whence the specific name. It has apparently been attached by one corner, which is much frayed out. Length 131 mm., breadth 88 mm., thickness 69 mm. *Colour* in spirit yellowish-grey. *Texture* very soft and yielding, but fibrous. *Surface* even, but minutely hispid. *Dermal membrane* thin and transparent. *Oscula* (Pl. XVI. fig. 2*b*, *o*) very distinct and characteristic, consisting of numerous short, wide, tubular processes, scattered over the upper end of the sponge. The wall of each tube is thin and membranous, strengthened by very closely placed spiculo-fibres, which, on approaching the free edge, break up into their component spicules, which form a slight projecting fringe around the osculum. Average width of osculum about 8·3 mm. Length of tubular process about 6·2 mm. There are about twenty such oscula, and they are confined to the upper end of the sponge. *Pores* distinct, very numerous, scattered irregularly over the surface of the sponge, so closely placed as to reduce the dermal membrane to a network; shape generally oval, longest diameter about 0·15 mm.

Skeleton.—(*a*) *Dermal;* absent, except in the tubular processes around the oscula, as described above. (*b*) *Main;* composed of an irregular, rather loose reticulation

[1] *Mém. Acad. Sci. St. Petersb.*, vol. xxvi. pt. vii. p. 23.

of spiculo-fibre. The main fibres run vertically to the surface, branching freely as in *Esperella arenicola*, nobis, and terminate in bunches of free spicules, the points of which project a little way beyond the dermal membrane.

Spicules.—(*a*) *Megasclera;* of one kind only, viz., styli (Pl. XV. fig. 2), with a slight tendency to become tylostylote by the development of a long oval head; broadest at about the middle and tapering to a rather sharp point at the apex; size about 0·9 by 0·02 mm. (*b*) *Microsclera;* large palmate anisochelæ of very remarkable shape and singular beauty (Pl. XV. figs. 10, 10*a*); the whole spicule measuring up to 0·094 mm. in length. They never seem to occur in rosettes. Numerous young ones are also present. No other microsclera are present, but the chelæ occur in the greatest profusion.

This is one of the most satisfactory species in the collection, being excellently characterised both by its external form and by its spiculation. In the absence of a dermal skeleton reticulation it agrees with *Esperella nuda* and *Esperella arenicola*, nobis, and differs widely from *Esperella murrayi*, nobis, with which its definite external form would seem to associate it. To the absence of a dense dermal reticulation, such as exists in *Esperella murrayi*, is probably due the fact that the pores are not collected into definite pore-areas, all parts of the dermal membrane, excepting just where the spicular tufts project, being suitable for them. In connection with the great development of the teeth of the smaller end of the anisochela it is perhaps worth calling attention to this spicule in *Esperia lanugo*, Schmidt,[1] which is described as having this end unusually developed, individual spicules showing a completely isochelate condition; it is not figured, but Schmidt would probably have described the outward turning of the lateral teeth of the smaller end had it, as here, occurred in his species.

Embedded in the soft tissues of the sponge, beginning at about a third of an inch below the surface, are an immense number of little yellow embryos (Pl. XVI. fig. 2*a*, *e*), which will be found fully described in the Introduction.

Locality.—Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; off the mouth of the Rio de la Plata; depth, 600 fathoms; bottom, green sand; bottom temperature, 37°·2. One fine specimen in excellent condition.

Esperella parishii, Bowerbank, sp.

1875. *Raphiodesma parishii*, Bowerbank, Proc. Zool. Soc. Lond., April 1875, p. 283.
1880. *Amphilectus parishii*, Vosmaer, Notes from the Leyden Museum, vol. ii. p. 119.
1884. *Esperia parishi*, Ridley, Zool. Coll. H.M.S. "Alert," p. 436.

With this species we identify a thinly incrusting sponge from the Philippine Islands. As it has been fully described (but unfortunately not figured) by Bowerbank (*loc. cit.*), it

[1] *Jahresb. Comm. Wiss. Unters. deutsch. Meere*, ii., iii. p. 118.

is only necessary here to give some further account of the different spicular forms present. Vosmaer (*loc. cit.*), following Bowerbank, sums up the spiculation as follows:—"Spic. tr. ac.; tr^{02}.; ∧; ∽ (large ones and minute ones); rut. rut. ('congregated in groups,' large and strong); rut. rut. ('minute'); anc. anc. ('minute'); anc $^{2}2$. ('large and stout')." By careful comparison of Bowerbank's own preparations with those from the Challenger specimen, we have satisfied ourselves as to the identity of the two. There can be no doubt that Bowerbank has mentioned as proper to the sponge certain forms of spicules which are really foreign, and he has also omitted to mention the trichodragmata, which are present in his preparations. These facts are pointed out in the "Alert" Report (*loc. cit.*) by Ridley, who gives the following as the true spiculation:—

"1. Smooth, subspinulate acuate, with slight elongate head; basal end slenderer than middle of shaft: ·33 by ·013 millim.
"2. Large inequianchorate; large end comparatively short, its tubercle long and narrow: ·057 millim. long.
"3. Navicular equianchorate: ·013 millim. long.
"4. Bihamate, smooth, contort: ·095 by ·008 millim.
"5. Trichite spicules in bunches of two to four or five: ·032 to ·16 by ·0018 millim."

Locality.—Station 208, January 17, 1875; lat. 11° 37′ N., long. 123° 31′ E.; depth, 18 fathoms; bottom, blue mud. One specimen, encrusting a *Pecten* shell.

Habitat.—Straits of Malacca (Bowerbank); Port Darwin, Australia (Ridley); Philippine Islands (Challenger). Shallow water.

Esperella gelatinosa, Ridley, sp. (Pl. XVI. fig. 7).

1884. *Esperia gelatinosa*, Ridley, Zool. Coll. H.M.S. "Alert," p. 611, pl. liv. figs. *f–f'''*.

This species, which was obtained abundantly by the "Alert" expedition at Providence Reef and Providence Island, Mascarene group, is represented in the Challenger collection by one fine specimen from Cape York, Torres Strait. The Challenger specimen (Pl. XVI. fig. 7) is much larger than any previously obtained, and is divided into three lobes, the largest of which has a height of 45 mm. by a maximum breadth of 22 mm. As the species has already been fully described (*loc. cit.*), further details would be superfluous.

Locality.—Cape York, Torres Strait, 3 to 11 fathoms. One fine specimen.

Habitat.—Mascarene Islands (Ridley); Torres Strait (Challenger). Shallow water.

Esperella magellanica, Ridley, sp.

1881. *Esperia magellanica*, Ridley, Proc. Zool. Soc. Lond., January 1881, p. 117, pl. x. fig. 5, *a. b. c. d. e.*

1882. *Esperia Cunninghami*, Carter, Ann. and Mag. Nat. Hist., ser. 5, vol. ix., p. 300, pl. xi. fig. 17.

This species has already been described by Ridley (*loc. cit.*), we shall therefore only add a few particulars to that description. The pores, which have not been hitherto described, are very distinctly shown in the Challenger specimen. They are round openings in the dermal membrane, about 0·1 mm. in diameter, which occur irregularly scattered between the reticulations of the dermal skeleton; they do not seem to be localised in pore-areas.

Immediately beneath the dermal membrane occur immense quantities of large globular yellow cells, measuring 0·02 mm. in diameter, usually aggregated in heaps so as to resemble the roe of a herring. When mounted in Canada balsam without staining, these bodies appear of a deep yellow colour. They stain fairly readily with borax carmine; when treated with a strong solution of iodine in hydriodic acid they assume a purple tinge, and then become black. Sometime a distinct, large nucleus can be distinguished, but more often the cells seem simply to be filled with a granular substance. We think there can be little doubt that these bodies are parasitic Algæ, and not, as stated in Ridley's original description, pigment-cells.

This species was originally discovered by the "Nassau" expedition, and is mentioned in Dr. Cunningham's Notes on the Natural History of the Strait of Magellan, 1871, p. 481.

Locality.—Station 313, January 20, 1876; lat. 52° 20′ S., long. 67° 39′ W.; east of Cape Virgins, near the entrance to the Strait of Magellan; depth, 55 fathoms; bottom, sand; bottom temperature, 47°·8. One good-sized fragment.

Habitat.—Sandy Point, Strait of Magellan (Ridley, "Alert"); Otter Island, Patagonia (Cunningham); east of Cape Virgins (Challenger).

Esperella murrayi, Ridley and Dendy (Pl. XIII. figs. 11, 13, 14, 16, 17, 18; Pl. XIV. figs. 1, 1*a*).

1886. *Esperella murrayi*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 338.

Sponge (Pl. XIV. fig. 1) massive; lobate. Arising from a comparatively narrow base (41 mm. in greatest diameter), it rapidly expands, and is broadest near the summit, having a maximum breadth of 116 mm. Height, 162 mm. The shape may be roughly compared to that of an inverted triangular pyramid. A broad, rounded lobe occupies each corner of the base of the pyramid; and between these lobes, instead of a flat base there is a deep depression, while down each of the remaining

three faces of the pyramid there is a broad groove; hence the sponge might also be described as composed of three broad, ascending, divergent lobes, arising from a common base, and united together almost up to their apices. *Colour* in spirit pale yellow. The *texture* of the sponge is very firm and dense, but internally it is traversed by wide canals. The *dermal membrane* is thin and transparent, loaded with mega- and microsclera. The *surface* is smooth and even, except for numerous irregular cracks which traverse it in every direction. These cracks (Pl. XIV. fig. 1, *p.a.*) form a reticulation all over the surface, except on the summits of the lobes, where they are absent. The effect thus produced closely resembles that of sun-cracks upon a cake of mud. Some of the cracks are quite closed, others are gaping, and in the latter condition they are seen to be crossed, at a little distance below the general surface of the sponge, by a delicate membrane, while in this membrane, from wall to wall of the crack, run very numerous transverse bands of fibres, distinctly visible to the naked eye.

Upon examining prepared sections with the microscope the real meaning of these cracks is at once seen. They are pore-areas (Pl. XIII. fig. 16). The delicate membrane forming the floor of each is pierced by numerous small holes, the *pores*, which reduce it to a mere sieve. These pores are about 0·06 mm. in diameter, and lead into large subdermal cavities, immediately underlying the cracks. The terminal branches of the incurrent canal system open out of these subdermal cavities by round mouths about 1 mm. in diameter. The bands of fibres above mentioned, which run across in the pore-bearing membrane from side to side of the cracks, stain deeply in borax carmine, and there can be little doubt that they are contractile bands, or, in other words, muscles, whose function is to open and close the cracks and thus to regulate the supply of water. A few pores also occur scattered in the dermal membrane, over the general surface of the sponge.

Although more properly coming under the head "Skeleton," we cannot here pass over the way in which the edges of the pore-bearing cracks are formed. Each edge is guarded by a bristling row of projecting spicule-points. The spicules to which these points belong are arranged in tufts; each tuft radiates from a point below the dermal membrane, a little to one side of the crack, and the spicules project obliquely upwards and terminate in the fringe along the edge of the crack (*vide* Pl. XIII. fig. 16).

The *oscula* are grouped on the summits of the lobes (Pl. XIV. fig. 1, *o*, and fig. 1*a*), and with this fact must be connected the absence of pore-bearing cracks in these regions. There are in all about twenty oscula, averaging in diameter about 4 mm.

Skeleton.—(*a*) *Dermal;* a very dense, felted layer of stylote spicules, laid horizontally and not arranged in fibres. (*b*) *Main;* a rather irregular but compact reticulation of dense spiculo-fibre, in which one may distinguish main fibres running vertically to the surface of the sponge, and secondary fibres crossing these at right angles. As the main fibres approach the surface the spicules composing them spread

out into broad tufts, and their ends penetrate into the dermal layer and project very slightly beyond the surface; it is generally the pointed ends of the styli which thus project. The peculiar arrangement of the spicular tufts along the edges of the pore-bearing cracks has already been described.

Spicules.—(*a*) *Megasclera;* of one kind only, viz., styli (Pl. XIII. fig. 18), very nearly straight, tapering from near the middle towards both ends, and measuring about 0·7 by 0·019 mm. (*b*) *Microsclera;* these are enormously abundant, both in the dermal membrane, including the pore-bearing areas, and in the deeper tissues. Three kinds occur, all plentiful:—(1) Large palmate anisochelæ (Pl. XIII. fig. 17); especially abundant in the dermal membrane, up to 0·072 mm. long, with the large end 0·019 mm. broad. These chelate spicules are often found in very beautiful rosettes, which seem to occur chiefly, if not solely, just beneath the dermal membrane. Numerous small anisochelæ are also present, perhaps young forms of the large ones. (2) Numerous sigmata (Pl. XIII. fig. 11) of the usual shape, frequently much contorted, measuring about 0·053 by 0·0024 mm. (3) Trichodragmata (Pl. XIII. fig. 14), occurring in great profusion in the deeper tissues, measuring about 0·076 by 0·013 mm.

For further details as to the minute anatomy and histology the reader is referred to the Introduction (Anatomy and Histology).

This is one of the finest and most interesting sponges in the collection, and forms a splendid example of the manner in which the pores may be collected into certain definite "*pore-areas*," a phenomenon which has already been noted by Sollas[1] for other species of the genus *Esperella*. But we have here a still further development, for not only are the pores, for the most part, definitely localised, but the grooves in which they occur may be opened or closed by appropriate muscles, and thus the supply of water regulated with great precision. The transverse muscle-fibres of the pore-bearing cracks may be compared with the fibres which sometimes form sphincters around the individual pores[2] in other sponges.

In the mæandering pore-areas and the almost stony spicular and non-reticulate dermis this species stands markedly apart from all other described species, so far as they are known to us; the spiculation, on the other hand, as often happens in such cases, is of an ordinary type.

Locality.—Off Port Jackson, 30 to 35 fathoms. One specimen.

Esperella porosa, Ridley and Dendy (Pl. XV. figs. 6, 9, 17; Pl. XVI. fig. 5).

1886. *Esperella porosa*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 338.

Sponge (Pl. XVI. fig. 5) cylindrical; length of largest specimen about 50 mm. Diameter about 6 mm. *Colour* in spirit nearly white. *Texture* fibrous, but open and

[1] *Vide Ann. and Mag. Nat. Hist.*, ser. 5, vol. ix. p. 437.

[2] *Vide* Vosmaer, Bronn's Klass. u. Ordn. des Thierreichs, Porifera, p. 125.

rather soft. *Surface* even but minutely hispid; with a porous appearance due to the close reticulation of the dermal skeleton. *Dermal membrane* (?) (nearly all rubbed off). *Pores* (?). *Oscula;* one specimen shows two small, conical, tubular projections, each with an osculum at the summit (Pl. XVI. fig. 5, *o*).

Skeleton.—(*a*) *Dermal;* a very close and compact reticulation of dense spiculo-fibre, the meshes of the network being about 0·3 mm. and the fibres themselves about 0·08 mm. in diameter. Numerous spicules project more or less vertically from the fibres, thus causing the hispid appearance of the surface. (*b*) *Main;* a loose reticulation of dense, stout spiculo-fibre, which branches and anastomoses. As they approach the surface the fibres expand into brushes of spicules upon which the dermal layer rests. The spicules composing the fibres are united together by a fair proportion of spongin.

Spicules.—(*a*) *Megasclera;* of one kind only, viz., tylostyli (Pl. XV. fig. 6), stoutest in the middle, with a small head at one end, separated by a slight constriction from the shaft; tapering rather suddenly to a sharp point at the apex. Size about 0·38 by 0·016 mm. (*b*) *Microsclera;* of two kinds; (1) palmate anisochelæ (Pl. XV. fig. 17), rather small for an *Esperella*, about 0·05 mm. long; with a long, narrow palm at the large end; (2) large, smooth, simple and contort sigmata (Pl. XV. fig. 9), measuring about 0·16 by 0·0085 mm.

This species may be most readily recognised by the character of the dermal skeleton reticulation. It is represented in the collection by only two fragments, one of which has an interesting and peculiar habit. It has grown around the stem of an Alcyonarian, which it has covered with a very thin horny layer containing the proper spicules of the sponge, the tylostyli being mostly placed longitudinally. This horny coating is easily separable from the Alcyonarian stem, and forms by itself a hollow cylinder from which the skeleton fibres arise.

This species appears to resemble *Esperella velutata*, Lbkn. sp., as far as spiculation is concerned, but the descriptions given of the latter are too imperfect for identification and the great difference in locality, the one being found at Port Jackson and the other at Venice, renders it improbable that they are the same species.[1]

Locality.—Off Port Jackson, 30 to 35 fathoms. Two small specimens.

Esperella nuda, Ridley and Dendy (Pl. XV. figs. 5, 11, 14; Pl. XVI. fig. 1).

1886. *Esperella nuda*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 339.

Sponge (Pl. XVI. fig. 1) encrusting an irregular mass of dead spiculo-horny fibre belonging to an *Esperella*, probably of the same species. Sometimes the naked amber-coloured fibre projects far beyond the surface of the sponge. *Colour* in spirit pale yellow.

[1] For *Esperella velutata*, *vide* O. Schmidt, Spongien des Adriatischen Meeres, p. 57; also Vosmaer, Notes from the Leyden Museum, vol. ii. p. 141.

Texture soft. *Surface* minutely hispid. *Dermal membrane* distinct, thin, transparent. *Pores* collected into groups, forming small, more or less circular pore-areas, each containing up to about twelve pores, but generally less. The groups themselves are placed close together, scattered over the surface of the sponge. Diameter of the pore-areas about 0·3 mm., of the pores about 0·07 mm. The pores are placed very close together within the pore-areas, being separated only by narrow strands of tissue.

Skeleton.—The mass of fibre on which the sponge is based, and which it encrusts, is coarse, amber-coloured, branching and anastomosing, with a very large proportion of horny matter and a core of tylostylote spicules of the characteristic *Esperella* type. This fibre was certainly dead before the present sponge grew over it, as it projects far beyond the soft parts, and the central canals of the enclosed spicules are enlarged; it appears, however, probable that it belongs to an older specimen of the same species. The specimen has in addition its own proper fibre. There is, however, no dermal reticulation. The deeper skeleton consists of a very loose reticulation of spiculo-fibre, very densely spiculous and with very little horny matter. The main fibres are very broad, and as they approach the surface they subdivide and subdivide again, forming spreading tufts of fibres, each ultimate fibre of which breaks up into a brush of separate spicules whose ends project freely beyond the surface of the sponge, penetrating the dermal membrane. The proper fibre of the sponge is probably thus poorly developed owing to the fact that it makes use of the dead skeleton of another sponge.

Spicules.—(*a*) *Megasclera;* of one kind only, viz., tylostyli (Pl. XV. fig. 5), with small head and slightly constricted neck, tapering rather suddenly to a very sharp point and broadest near the apex; size 0·245 by 0·016 mm. The spicules mentioned above as occurring in the horny fibre on which the sponge is based are of about the same length but slenderer. (*b*) *Microsclera;* (1) rather small palmate anisochelæ (Pl. XV. fig. 11), with a long, narrow palm at the large end; length of spicule about 0·025 mm.; (2) rather large, smooth, simple and contort sigmata (Pl. XV. fig. 14), measuring about 0·12 by 0·0063 mm. The chelate spicules seem to be almost confined to the dermal membrane and are not very abundant even there, while the sigmata are plentiful, both in the dermal layer and in the deeper tissues. The sigmata are often found in groups, in which the spicules are placed close together and parallel with one another.

A noteworthy feature about this species is the absence of a dermal skeleton reticulation. In spiculation it agrees closely with *Esperella porosa*, nobis. The habit of the sponge is very remarkable, the specimen in question having made use of an old and dead skeleton, perhaps of the same species.

Locality.—Off Bahia, shallow water. One specimen.

Esperella fusca, Ridley and Dendy (Pl. XIV. fig. 4; Pl. XV. figs. 3, 3*a*, 15, 15*a*).

1886. *Esperella fusca*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 339.

Sponge (Pl. XIV. fig. 4) small, incipiently lobose, rounded, penetrated through and through by the branches of some Alga. Greatest diameter rather under 25 mm. *Colour* in spirit dark greyish-brown. *Texture* soft, resilient. *Surface* very slightly roughened by the presence of the dermal skeleton reticulation, but not hispid; uneven, with rounded elevations and depressions. *Dermal membrane* distinct, transparent. *Oscula* few, small, with their margins produced into small elongated tubes. *Pores* few, small, scattered; diameter about 0·025 mm.

Skeleton.—(*a*) *Dermal;* composed of two layers:—(1) an upper layer, consisting of a rather close, irregular spicular reticulation, in which several spicules often lie side by side forming rudimentary fibres; and (2) a lower layer, consisting of a reticulation of fairly stout, compact, spiculo-fibre, with rounded or polygonal meshes. (*b*) *Main;* composed of loose, branching spiculo-fibre. The main fibres do not, as in so many *Esperellæ*, break up into distinct divergent brushes of spicules on approaching the surface, hence the surface is not hispid.

Spicules.—(*a*) *Megasclera;* of one kind only, viz., tylostyli (Pl. XV. figs. 3, 3*a*), often curved, with distinct oval heads and usually much blunted at the apex; size about 0·455 by 0·0126 mm. (*b*) *Microsclera;* (1) a few palmate anisochelæ (Pl. XV. figs. 15, 15*a*), of the usual *Esperella* type (sometimes in rosettes?); length about 0·063 mm.; numerous smaller ones also occur, probably young forms of the larger. (2) Small, slender sigmata, usually contort, length about 0·044 mm. (3) Trichodragmata, forming small, compact, oblong bundles, measuring about 0·03 by 0·063 mm.; especially abundant in the dermal layer.

This sponge is remarkable for the ease with which the flagellated chambers can be made out. If a fragment, without any staining, be teased up in a drop of Canada balsam, the flagellated chambers are separated out in enormous numbers from the surrounding matrix, and appear under a low power of the microscope as spherical or oval bodies, composed of aggregations of large granules. Further details concerning them will be found in the Introduction. They are about 0·03 mm. in diameter.

Locality.—Off Bahia; depth, 17 fathoms. Four specimens.

Esperella arenicola, Ridley and Dendy (Pl. XV. figs. 4, 4*a*; Pl. XVI. fig. 8).

1886. *Esperella arenicola*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 339.

Sponge (Pl. XVI. fig. 8) massive, flat, cake-like. Length of largest piece 175 mm.; breadth 81 mm.; thickness 16 mm. *Colour* in spirit light brown. *Texture* fragile,

brittle, extremely sandy. *Surface* rough and uneven, owing to the numerous foreign bodies, Mollusc shells, Polyzoa, &c., with which the sponge is thickly encrusted. *Dermal membrane* thin and transparent. *Oscula* scattered, small and round, with their margins level with the general surface of the sponge, about 2·5 mm. in diameter.

Skeleton.—There is no dermal reticulation at all. The main skeleton is very loose. The primary fibres are thin, and give off branches at very sharp angles, recalling the ramification of the Broom. As they approach the surface of the sponge the primary fibres break up into branches, each of which terminates in a slightly divergent tuft of long, slender spicules which project little, if at all, beyond the dermal membrane.

Spicules.—(*a*) *Megasclera;* of one kind only, viz., tylostyli (Pl. XV. figs. 4, 4*a*), long and very slender, each with a distinct head, and tapering gradually to a fine point at the apex; size about 0·4 by 0·0072 mm. (*b*) *Microsclera;* (1) small, slender, palmate anisochelæ, about 0·028 mm. long; (2) rather large, simple and contort sigmata, measuring about 0·077 by 0·0048 mm.; (3) trichodragmata, size about 0·35 by 0·07 mm.

As already noticed, this sponge is very full of foreign bodies, and this renders it difficult to obtain a satisfactory section. Indeed it seems as if the poor development of the skeleton might be due to its partial replacement by foreign bodies. If we imagine the process of degeneration proceeding a few steps further, we arrive at the condition of Marshall's *Phoriospongiæ*, the real nature of which has been discussed elsewhere.

The small size of the chelæ and the absence of a dermal skeleton are good characters of this species. There can be little doubt that the modifications in the skeleton are due to the sponge having lived on a shelly bottom.

Locality.—Station 162, April 2, 1874; lat. 39° 10′ 30″ S., long. 146° 37′ 0″ E.; off East Moncœur Island, Bass Strait; depth, 38 fathoms; bottom, sand and shells. One large specimen and some fragments.

Esperella simonis, Ridley and Dendy (Pl. XV. figs. 7, 7*a*, 12, 12*a*, 13, 16, 16*a*, 16*b*, 16*c*).

1886. *Esperella simonis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 339.

Sponge branching, cylindrical (but rather angular), or more or less massive. Diameter of branches about 8 mm.; length of largest fragment 45 mm. *Texture* fibrous, elastic. *Surface* somewhat uneven and minutely hispid. *Dermal membrane* thin, transparent, distinct. *Oscula* (?) small, scattered. *Pores* distinct, numerous, round openings in the dermal membrane, about 0·063 mm. in diameter; irregularly scattered, but very close to one another.

Skeleton.—(*a*) *Dermal;* a rather irregular reticulation of spiculo-fibre, in some places very much closer than in others, the extra closeness being due to numerous loose spicules irregularly scattered between and across the fibres. In the looser parts, the

dermal reticulation is seen to be arranged in a rotulate manner, similar to the dermal reticulation of Bowerbank's *Desmacidon rotalis*[1] (= *Esperella rotalis*), but hardly so regular as shown in his figure. (*b*) *Main;* it is difficult to make out any definite arrangement. In the cylindrical pieces there appears to be a central, rather loose core of thick spiculo-fibre; one can also distinguish thick bands of spiculo-fibre running more or less vertically to the surface; on approaching the surface the fibre opens out slightly and the points of the spicules composing it project a little way beyond the dermal membrane, thus causing the minute hispidation already noticed. The spiculo-fibre of the main skeleton is generally dense and thick.

Spicules.—(*a*) *Megasclera;* of one kind only, viz., tylostyli (Pl. XV. figs. 7, 7*a*), tapering towards the base so as to form a neck and then enlarging slightly to form the small head; towards the apex the spicule tapers very gradually to a sharp point; size about 0·4 by 0·0145 mm. (*b*) *Microsclera;* (1) large and peculiarly-shaped, palmate anisochelæ (Pl. XV. figs. 16, 16*a*, 16*b*, 16*c*), measuring about 0·072 mm. in length, with the large end 0·036 mm. wide; for further particulars as to their shape see the figures (*loc. cit.*). These spicules are frequently seen to echinate the skeleton fibre, being themselves arranged in groups, with their truncated small ends placed close together upon the spiculo-fibre and their large ends radiating outwards (perhaps the truncation of the small ends may be due to this peculiar habit). Plenty of the large anisochelæ are also found lying freely in the tissues. Numerous smaller anisochelæ also occur, which differ from those just described in having the large end relatively of greater size; they differ also slightly in general shape, but they have the cup-shaped, truncated small end found in the larger ones, and we are inclined to think that they are young forms of the latter (*vide* Pl. XV. fig. 16*c*). There are also some minute anisochelæ, probably still younger forms of the same. Neither of the small forms appear to be attached to the skeleton fibre, as the large ones are. (2) Very large, thick, smooth, contort sigmata (Pl. XV. fig. 13), something like the diancistra found (*e.g.*) in *Vomerula esperioides*, nobis, but without the membranous expansions and with no notch in the centre of the shaft; size 0·24 by 0·019 mm. These spicules are also very often found adhering, usually by their backs, to the skeleton fibre, which thereby acquires a very formidable appearance. (A similar arrangement of the large diancistra may be seen in *Vomerula esperioides*, nobis, and in *Hamacantha johnsoni*, Bk., sp.) (3) Very fine, single, scattered, smooth toxa (Pl. XV. figs. 12, 12*a*), measuring about 0·145 by 0·003 mm.

This is a highly interesting species; unfortunately, it is represented in the collection by only a few fragments. With, so far as we can judge, a very insignificant external form, it combines a spiculation which in beauty and variety is hardly surpassed among the known Monaxonida. One of the most remarkable features about it

[1] Mon. Brit. Spong., vol. iii. p. 327, pl. xc. figs. 8–14.

is the way in which two out of the three microsclera attach themselves to the skeleton fibre. It is a rather remarkable fact that we can find no spicules which we can put down as young forms of the large sigmata, except a very few, which somewhat resemble them in shape and size but are much more slender, and appear as if they might form links connecting the large with the ordinary, small sigmata.

Locality.—Simon's Bay; depth, 10 to 20 fathoms. Three fragments.

Esperella biserialis, Ridley and Dendy (Pl. XIV. figs. 2, 3; Pl. XV. figs. 8, 8*a*, 8*b*).

1886. *Esperella biserialis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 340.

Sponge (Pl. XIV. figs. 2, 3) consisting of a long, slender axis, perfectly straight and somewhat flattened in one plane, from which arise very short, slender, straight spicular processes. These processes are arranged in two opposite series, at either end of the longer transverse diameter of the sponge, forming on each side a single long row of closely placed, hair-like projections. The axis of the sponge is somewhat twisted, so that the two rows are not quite straight. It is covered with a thin crust of brown, transparent tissue, containing many spicules, and terminates abruptly at the lower end, having apparently been broken off short, while at the upper extremity it ends in a slightly rounded apex. Length of sponge 92 mm.; longer diameter 1 mm. *Surface* hispid. *Dermal membrane* fairly distinct.

Skeleton.—(*a*) *Dermal;* from an imaginary line, drawn longitudinally down the middle of each flattened side of the sponge, a large number of tylostylote spicules diverge more or less at right angles towards either side. These spicules have their bases placed along the middle line, while their apices are directed towards the bases of the hair-like processes, which they are just about able to reach. This arrangement is easily recognisable, though not very regular, for many of the spicules are placed so as to project from the surface of the sponge, giving to it the hispid appearance described. (*b*) *Main;* a central, dense spicular axis composed of very long styli firmly united together, from two sides of which come off short, hair-like fibres as already described (the spicular processes). Outside the axis there are also longitudinal bands of spiculo-fibre, apparently not arranged in any very definite manner.

Spicules.—(*a*) *Megasclera;* of two kinds. (1) Very long, slender styli (Pl. XV. figs. 8*a*, 8*b*), of extremely elegant shape, becoming gradually inflated in the centre, but very thin at both ends. Apex not very sharply pointed; no head. These spicules may reach over 2 mm. in length, with a diameter in the middle of 0·038 mm.; they occur only in the main axis. (2) Rather short tylostyli (Pl. XV. fig. 8), broadest near the apex, each hastately pointed and with a distinct, elongated head narrowing towards the top; size about 0·44 by 0·01 mm.; these occur in the dermal skeleton, in the longitudinal fibres outside the axis, and in the hair-like projections. (*b*) *Microsclera;*

(1) very minute palmate anisochelæ, length about 0·0126 mm; (2) small, slender sigmata, often contort; length about 0·025 mm.

This species forms a most interesting and important link between the two genera *Esperella* and *Cladorhiza*, especially as regards external form. It is also particularly interesting in that it exhibits a distinctly bilateral symmetry; in this respect it is approached by *Cladorhiza pennatula*, Schmidt;[1] the latter has, however, a much coarser and less delicate form.

The species may be readily recognised by the very minute microsclera, the extraordinary external form, and the two kinds of megasclera, though the latter are both, doubtless, merely modifications of one and the same type.

Localities.—Station 281, October 6, 1875; lat. 22° 21′ S., long. 150° 17′ W.; South Pacific; depth, 2385 fathoms; bottom, red clay; bottom temperature, 34°·9. One specimen, which still retains the soft parts.

Station 291, October 27, 1875; lat. 39° 13′ S., long. 118° 49′ W.; South Pacific; depth, 2250 fathoms; bottom temperature, 34°·6; bottom, red clay. One specimen, with the soft parts washed off, but still retaining a few microsclera and exhibiting very beautifully the biserial arrangement of the lateral processes.[2]

Esperella sp.

We have to record the occurrence of a single specimen of an *Esperella* (species unknown) from Bass Strait, which is growing over the fibre of a Dysidean sponge; both the tylostylote megasclera and the anisochelæ are very much reduced, and we have seen no other kind of spicules. Under these circumstances it has not seemed to us desirable to found a new species for the reception of this sponge. The tylostyli are smooth, straight, slender, sharp-pointed, with slight oval heads, and commonly with much enlarged central canals; size about 0·28 by 0·0042 mm. The palmate anisochelæ are of very delicate appearance and about 0·022 mm. long.

Locality.—Station 162, April 2, 1874; lat. 39° 10′ 30″ S., long. 146° 37′ E.; Bass Strait; depth, 38 fathoms; bottom, sand and shells. One specimen.

Genus *Esperiopsis*, Carter (Pls. XVIII., XIX., XXVI., XXX., XLVI.).

1882. *Esperiopsis*, Carter, Ann. and Mag. Nat. Hist., ser. 5, vol. ix. p. 296.

Form various, amorphous or symmetrical. Megasclera all monactinal, styli or tylostyli, smooth; microsclera isochelæ, to which sigmata may be added.

[1] *Jahresb. Comm. wiss. Untersuch. deutsch. Meere*, Jahrg. ii., iii. p. 119, pl. i. figs. 14, 15.

[2] Lodged right within the spicular axis of one of the specimens were found a number of developing embryos, concerning which further details will be found in the Introduction. For this interesting discovery we are indebted to the careful observation of our artist, Mr. P. Highley.

This genus differs from *Esperella* only in having the chelate spicule equal-ended instead of unequal-ended. The original type of the genus is *Esperiopsis villosa*, Carter, a "Porcupine" sponge,[1] first described under the name *Esperia villosa*, and this has been hitherto the sole species included therein.

The Challenger adds six new species, and we must also include one old one, namely, *Esperiopsis edwardii*, Bowerbank, sp., represented in the collection by a new variety. The synonymy of the latter sponge will be found under the species.

Several of the species of this genus are remarkable for their well-defined external forms, which serve as excellent guides by which to separate them from one another and from others of the genus.

The distribution of the genus is very wide, both vertically and horizontally, but it appears to prefer deep water in temperate or boreal seas.

Esperiopsis symmetrica, Ridley and Dendy (Pl. XIX. figs. 6, 6′, 6*a*, 6*b*, 6*c*; Pl. XXVI. figs. 4, 4*a*; Pl. XLVI. fig. 7).

1886. *Esperiopsis symmetrica*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 340.

Sponge (Pl. XXVI. figs. 4, 4*a*) erect, straight, slender, cylindrical, unbranched (in so far as evidenced by the Challenger specimens), covered with numerous, long, slender spicular tufts, giving it the appearance of a bottle brush. The largest specimen is 44 mm. in length by 4 mm. in diameter (including the projecting processes, which are themselves about 1 mm. in length). *Colour* in spirit dark chocolate-brown. *Texture* fibrous and soft between the tufts of spicules. *Surface* closely beset with the projecting, seta-like processes already mentioned. (*Oscula* and *Pores* unknown.)

Skeleton.—Well seen in transverse or longitudinal section (Pl. XLVI. fig. 7). Radiately arranged. In transverse section the sponge is circular, and from its centre radiate numerous loose bands of spiculo-fibre, after the manner of the spokes of a wheel; these fibres (Pl. XLVI. fig. 7, *d*) project far beyond the surface of the sponge, thus causing the hairy appearance. At a short distance within the circumference of the sponge itself is a regular circle, formed by the cut ends of longitudinal bands of spicules; each group of cut ends occupying one of the segments between two radiating fibres. At a short distance outside this circle, just beneath the surface of the sponge, is another similar but much less regular circle of cut spicules. The longitudinal fibres of the skeleton are confined almost exclusively to these two sheaths, placed one within the other; the inner (Pl. XLVI. fig. 7, *b*) being fairly compact and well defined, but the outer (Pl. XLVI. fig. 7, *c*) irregular and diffuse, while sometimes the two run into one another. There are no definite longitudinal fibres in the centre of the sponge, but a few loose, more or less longitudinally placed spicules.

[1] *Ann. and Mag. Nat. Hist.*, ser. 4, vol. xiv. p. 213, pl. xiii. figs. 13–15; pl. xv. fig. 36.

Spicules.—(*a*) *Megasclera;* of one kind only, viz., long, smooth, slender, fusiform styli (Pl. XIX. figs. 6, 6′), size variable, about 0·8 by 0·028 mm., usually, however, slenderer. (*b*) *Microsclera;* of two kinds; (1) large palmate isochelæ (Pl. XIX. figs. 6*b*, 6*c*), of the *Esperella* type, only with equal instead of unequal ends, length about 0·037 mm.; (2) very minute and slender sigmata, usually much contort, enormously abundant, length about 0·013 mm.; (3) much larger, very slender sigmata (Pl. XIX. fig. 6*a*).

This is a very remarkable sponge, the most noticeable feature in which is the radiately symmetrical arrangement of the skeleton. In external appearance it somewhat resembles a *Cladorhiza*. In one of the specimens a great number of embryos (Pl. XLVI. fig. 7, *e*) were found just beneath the surface of the sponge, lying, for the most part, between the two sheaths of longitudinal fibres.

As the dark brown colour of the specimens is shared by other things in the same bottle it is possibly due to a discoloration of the spirit in which they were preserved; it should be noted that the tissues, even to the centre of the sponge, are all diffusely stained with the same rich chocolate tint.

Carter's *Esperia borassus* ("Porcupine" collection) has an almost identical external form, but our sponge stands alone in this respect among its immediate congeners.

The megasclera are large, but only about half as long as those of *Esperiopsis profunda* (see below), and the species is further remarkable for having sigmata.

Locality.—Station 145A, December 27, 1873; lat. 46° 41′ S., long. 38° 10′ W.; off Prince Edward Island; depth, 310 fathoms; bottom, volcanic sand. Three pieces.

Esperiopsis edwardii, Bowerbank, sp., var. *americana* (Pl. XIX. figs. 7, 7′, 7*a*).

1866. *Isodictya Edwardii*, Bowerbank, Mon. Brit. Spong., vol. ii. p. 325; vol. iii., pl. lviii. figs. 15–18.
1866. (?) *Isodictya paupera*, *Id.*, *Op. cit.*, vol. ii. p. 328; vol. iii., pl. lv. figs. 4–7.
1866. (?) *Isodictya gracilis*, *Id.*, *Op. cit.*, vol. ii. p. 331; vol. iii., pl. lviii. figs. 23–26.
1880. *Amphilectus gracilis*, Vosmaer, Notes Leyden Mus., vol ii. p. 111.
1883. *Amphilectus Edwardi*, Ridley, Journ. Linn. Soc. Lond. (Zool.), vol. xvii. p. 106.

Sponge massive, erect, in the form of a somewhat pyramidal column, 137 mm. in height and about 44 mm. in diameter at the base; based upon a stone, which is encrusted with Polyzoa. *Colour* in spirit greyish-yellow. *Texture* rather soft and spongy. *Surface* glabrous, but covered with low conuli. *Dermal membrane* distinct, thin, transparent. *Pores* small, and scattered in irregular groups over the subdermal cavities. *Oscula* not very numerous, scattered, about 3 mm. in diameter.

Skeleton.—(*a*) *Dermal;* the dermal membrane has no special skeleton; the ends of the primary fibres of the main skeleton abut against it, and it also contains a few scattered stylote spicules. (*b*) *Main;* this is rather diffuse and Halichondrioid, but with distinct primary fibres running vertically towards the surface.

Spicules.—(*a*) *Megasclera;* of one kind only, viz., smooth, sharp pointed, slightly curved styli (Pl. XIX. figs. 7, 7′); size about 0·33 by 0·0126 mm. (*b*) *Microsclera;* of one kind only, viz., palmate isochelæ (Pl. XIX. fig. 7*a*), with only slightly curved shaft and with the extremity of the anterior palm slightly everted; length about 0·03 mm.

This sponge differs from Bowerbank's original mainly in its much more robust growth and (as evidenced by his preparations in the British Museum) in the superior stoutness of the stylote spicules (about 0·0126 as against 0·0078 mm.). The isochelate spicule in the Challenger sponge is also a little larger than in the British form. From an examination of Bowerbank's preparations we have been led to the conclusion that the isochelate spicule which he describes as tridentate is rather palmate, and that there is only one kind of megasclera, which varies somewhat in size. Examples of the same species obtained by the "Triton," off the east coast of Scotland, approach more nearly in external form to the Challenger variety, but still are not nearly so robust and massive.[1]

Locality.—Station 313, January 20, 1876; lat. 52° 20′ S., long. 67° 39′ W; east of the Strait of Magellan; depth, 55 fathoms; bottom, sand; bottom temperature, 47°·8. One fine specimen.

Esperiopsis cylindrica, Ridley and Dendy (Pl. XIX. figs. 2, 2*a*, 2*b*).

1886. *Esperiopsis cylindrica,* Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 340.

Sponge erect, cylindrical, branching dichotomously; consisting of a flattened, branching base, about 19 mm. in diameter, from which arises a simple, erect, cylindrical stem, about 4 mm. in diameter. At a height of 187 mm. above the base the main stem, after becoming slightly flattened, divides into two branches, each of which again divides into two; the total height of the specimen being 275 mm. *Colour* in spirit yellowish-grey. *Texture* hard and tough. *Surface* minutely hispid. *Dermal membrane* not very distinct; thin and transparent. Neither *pores* nor *oscula* observed.

Skeleton.—The centre of the sponge is occupied by a dense core of horny fibre, formed apparently by the almost complete fusion of several longitudinal fibres which are probably branches of the same. This horny core is covered only by a thin rind of granular tissue. A very large proportion of the spicular skeleton is, of course, embedded in the horny substance. There is one central, axial fibre of spicules, which does not, however, form a simple axis, but branches in a tree-like manner, the branches coming off at very acute angles; doubtless this main spicular axis and its branches are to be regarded as the proper core of the horny axis. There is also a system of primary fibres radiating from the central axis to the surface of the sponge; these, like the axial fibres just described, are composed for the most part of large stylote spicules; the inner end of each fibre is

[1] Ridley, *Journ. Linn. Soc. Lond.* (Zool.), vol. xvii. p. 106.

embedded in the horny axis, while the outer end projects beyond the surface in the form of a tuft of smaller stylote spicules; these tufts are sometimes seen with a single large stylote spicule in the centre, surrounded by the smaller ones. The primary skeleton lines are crossed by both vertical and horizontal secondary fibres, which are probably in part formed by the branching of the central axis. The whole system of fibres is rather confused.

Spicules.—(*a*) *Megasclera;* smooth styli, of two chief sizes; (1) stout, almost straight, unusually sharply pointed, variable in length, measuring up to about 0·7 by 0·023 mm. (Pl. XIX. fig. 2); (2) slender, straight, sharply pointed, variable in length, measuring up to about 0·7 by 0·0063 mm. (Pl. XIX. fig. 2*a*). The distribution of these two kinds of spicules has already been indicated; in addition to the tufts of slender spicules which project from the surface there is a zone of very slender, longitudinally placed styli at a short distance below the surface; indeed it is here that the slender styli attain their greatest length and slenderness, being both longer and more slender than those of the tufts, and it is from one of these longest that the above measurements have been taken. There is little doubt that we have in all these only slight modifications of one form of spicule. (*b*) *Microsclera;* (1) small palmate isochelæ (Pl. XIX. fig. 2*b*), extremely abundant in the dermal membrane but scanty below; length up to about 0·025 mm. (2) A very few smooth toxa, about 0·07 mm. long; we have only seen a few of these, so they may be foreign, but we think not.

The most remarkable feature of this sponge is the extraordinary development of horny matter. The whole sponge, its megasclera, and their arrangement, much recall the genus *Raspailia.*

Locality.—Off Port Jackson; depth, 30 to 35 fathoms. One specimen.

Esperiopsis challengeri, Ridley, sp. (Pl. XVIII.; Pl. XIX. figs. 8, 8*a*, 8*b*).

1885. *Amphilectus challengeri*, Ridley, Narr. Chall. Exp., vol. i. pt. 2, p. 570, fig. 187.
1886. *Esperiopsis challengeri*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 341.

Sponge (Pl. XVIII. figs. 1, 2, 3) of very definite, beautiful and symmetrical external form, a good idea of which will be obtained by reference to the figures.[1] From a slightly expanded base, which has evidently served to attach the sponge to the bottom upon which it grew, arises a straight or slightly curved stem, composed of densely packed and firmly united stylote spicules. This stem is very much compressed laterally, and from its anterior edge (as we shall term it) arise a number of short, simple branches, placed one above the other at gradually increasing intervals, thus dividing the stem into a series of unequal "internodes," the longest of which is at the top. The stem itself, and each of

[1] These drawings are by Dr. J. J. Wild, artist to the Expedition.

the branches terminate in a thick, fleshy lamella, of which there appear to be usually six or seven in a full-grown example, increasing gradually in size from below upwards. Each lamella has the form of a deeply concave, transversely elongated cup. The concave surface is directed towards the stem (posterior) while the convex surface is anterior, and the supporting branch, or peduncle, is inserted into the centre of the lower margin of each lamella; sometimes the weight of the large upper lamellæ causes the stem to droop considerably, and the lamellæ to hang down with their concave surfaces uppermost.

There are in the collection thirteen specimens, the stem of the smallest (Pl. XVIII. fig. 3) being only 38 mm. high, and bearing two rounded, cup-shaped lamellæ about 13 mm. in diameter. The following are the measurements of a very fine and apparently full-grown specimen, with six cup-shaped lamellæ. Diameter of expanded base 19 mm., thickness of same 8 mm. Height of stem, from the point where it rises out of the expanded base to its insertion into the margin of the uppermost cup-shaped lamella, 200 mm.; longer diameter of stem, at a point half way between the origins of the third and fourth branches, about 8 mm.; diameter at right angles to the above about 3 mm. Longest diameter of the uppermost lamella, 63 mm.; diameter at right angles to the above, 35 mm.; thickness of same, about 4 mm. *Colour* in spirit light yellow. *Texture*, of the stem, very dense and tough; of the lamellæ, rather soft and fragile, but firm. *Surface* of the stem markedly hispid. Concave surface of lamellæ slightly glabrous in appearance, but really very minutely hispid; convex surface, minutely hispid; both, as a rule, evenly rounded. *Dermal membrane* obvious only on the concave surface, where it is distinct, thin and very transparent. *Oscula* confined to the convex surfaces of the lamellæ, over which they are thickly and evenly scattered, small (averaging little over 0·5 mm. in diameter), round, and having their margins flush with the general surface of the sponge. *Pores* confined to the concave surfaces of the lamellæ, where they are enormously abundant, reducing the dermal membrane to a mere network (Pl. XVIII. fig. 4); they are almost circular openings and of very uniform size, averaging about 0·11 mm. in diameter. Indications are not wanting that these "pores" were, in the living condition, broken up into still smaller openings by bands of delicate membrane, but on this point we are not certain.

Skeleton.—(1) The skeleton of the stem; this consists simply of a dense core of closely packed stylote spicules, for the most part placed longitudinally, but with numerous spicules projecting at right angles, and thus giving to the stem its hispid character. (2) The skeleton of the lamellæ. (*a*) *Dermal;* supporting the dermal membrane on the concave surface is a fairly regular reticulation of rather stout spiculo-fibre, from which numerous spicules project outwards and thus give to the surface its hispid character; this reticulation is absent from the convex surface. (*b*) *Main;* each branch breaks up, at the point where it enters the lamella, into a number of radiating fibres, arranged in a fan-like manner, and in addition to the skeleton thus constituted there is a Halichon-

drioid reticulation of stylote spicules in which one can distinguish lines of fibre running vertically towards the surface and there breaking up into projecting tufts of spicules.

Spicules.—(*a*) *Megasclera;* of one kind only, viz., smooth, curved styli (Pl. XIX. fig. 8), gradually and sharply pointed, usual size about 0·35 by 0·0126 mm. (sometimes a little larger). (*b*) *Microsclera;* rather rare and of one kind only, viz., palmate isochelæ (Pl. XIX. figs. 8*a*, 8*b*); with almost perfectly straight shaft, length about 0·03 mm.

As regards external form this is one of the most remarkable sponges in the collection, although its spiculation is extremely simple. Coming from a depth of 825 fathoms it affords a capital example of the manner in which deep-sea Monaxonida tend to assume a definite and symmetrical external form. To judge from the number of specimens brought home by the Challenger it would appear to be a very abundant species at the place where it was found. From the fact that the main stem always terminates in a lamella, and that the smallest lamella is always found at the bottom of the series, we may pretty safely assume that growth takes place not from above but from below, and that while the upper lamellæ are gradually increasing in size, new small lamellæ are being one by one intercalated between the lowest previously existing one and the base. The correctness of this view as to the mode of growth is practically proved by the existence in the smallest specimen of a very minute bud on the stem below the lowest of the two lobes (*vide* Pl. XVIII. fig. 3, *a*).

The only described sponge at all resembling this species in its remarkable external form which we can recall is *Foliolina peltata*, Schmidt,[1] but even here the resemblance is not very great.

Locality.—Station 196, October 13, 1874; lat. 48° 30′ 0″ S., long. 126° 58′ 30″ E.; east of Celebes Island; depth, 825 fathoms; bottom, hard ground; bottom temperature, 36°·9. Thirteen specimens and some fragments.

Esperiopsis challengeri, var. *meangensis*, Ridley and Dendy.

1886. *Esperiopsis challengeri*, var. *meangensis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 341.

We propose the above name for a fragment of a stem and two fragments of a lamella which appear to have come from a specimen closely resembling the types of *Esperiopsis challengeri* in external appearance and also in spiculation. The differences, so far as we can at present judge, lie in the respective sizes of the spicules, and it is probable that when an entire specimen is found they will prove to be sufficiently great to justify the erection of a new species, when the varietal name given above will stand as a specific name. In favour of the view of the close relationship of the two is the nearness of their respective localities.

The spiculation of the variety in question is as follows:—(*a*) *Megasclera;* smooth, slightly curved styli, sharply pointed, varying a good deal in size, but much longer than

[1] Spong. Atlant. Gebiet., p. 42, pl. iv. fig. 4.

those of *Esperiopsis challengeri* proper. Length (in the lamella) up to about 0·63 mm.; breadth usually about 0·015 mm. In the fragment of stem the megasclera are much stouter, measuring about 0·6 by 0·025 mm. A few spicules of the stouter kind also occur in the lamella, their presence being apparently due to the breaking up and branching of the supporting stem; this shows that the fragments of lamella and stem probably belong to the same thing. (*b*) *Microsclera;* palmate isochelæ, large and numerous, length about 0·05 mm. (often less, and sometimes up to 0·072 mm.).

It will be seen that both microsclera and megasclera are considerably larger than in the types of *Esperiopsis challengeri.*

Locality.—Station 214, February 10, 1875; lat. 4° 33′ N., long. 127° 6′ E.; east of Meangis Island, south of Philippine Islands; depth, 500 fathoms; bottom, blue mud; bottom temperature, 41°·8. Fragments only.

Esperiopsis profunda, Ridley and Dendy (Pl. XIX. figs. 1, 1*a*, 1*b*).

1886. *Esperiopsis profunda,* Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 341.

There are in the collection two deep-sea sponges which we unite under the above name; neither is in very good condition; indeed the larger specimen is very imperfect and hence our description of the external form is taken from the smaller. Sponge consisting of a slender stem, composed of spiculo-fibre, expanded slightly below so as to form a flattened base, and gradually dilating above into a narrow, tubular, elongated head; we have found no definite opening from the exterior into the central cavity of this head, but the condition of the specimen does not warrant the assertion that none such exists. Total height of sponge, 44 mm.[1] Longer diameter of tubular head (which in its present condition is flattened) 4 mm.; diameter of stem near base 0·7 mm. *Colour* in spirit light yellowish-grey. *Texture* very soft and spongy. *Surface* hispid. *Dermal membrane, Oscula,* and *Pores* unknown.

Skeleton.—The skeleton of the head consists of a loose and confused reticulation of long stylote spicules, derived from the breaking up of the stem, at the point where it joins the head, into a number of thin, loose fibres, which radiate upwards through the walls of the tube and are crossed irregularly by other stylote spicules.

Spicules.— (*a*) *Megasclera;* of one kind only (Pl. XIX. fig. 1), viz., very long, rather slender and often very slightly curved, smooth styli, with evenly rounded base (sometimes, however, becoming tylostylote), and tapering very gradually to a sharp point at the apex; size about 1·4 by 0·0157 mm. (*b*) *Microsclera;* of one kind only, viz., large, palmate isochelæ (Pl. XIX. figs. 1*a*, 1*b*), with almost straight shaft and rather narrow front palm; these spicules may attain a length of 0·09 mm., but smaller ones about 0·05 mm. long are much more common.

[1] The larger specimen is a little over 100 mm. in height.

This sponge is interesting on account of the great depth (1600 fathoms) from which it was obtained, and with this must again be associated the presence of a definite external form. It is distinguished from other species of the genus by its very long megasclera and by the external form.

Locality.—Station 147, December, 30, 1873; lat. 46° 16′ S., long. 48° 27′ E.; between Prince Edward Island and Crozet Islands, Southern Ocean; depth, 1600 fathoms; bottom, Diatom ooze; bottom temperature, 34°·2. Two specimens, in bad condition.

Esperiopsis anomala, Ridley and Dendy.

1886. *Esperiopsis anomala*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 341.

Sponge digitate, irregularly ramose; branches subcylindrical, varying in diameter. One of the two specimens in the collection measures nearly 125 mm. in length but only about 6 mm. in average diameter. The second is about 50 mm. long and 8 broad, being somewhat compressed and giving off a few short, stumpy branches. *Colour* in spirit light greyish-yellow to dark grey. *Texture* very soft and compressible, but elastic, fibrous, and fairly tough. *Surface* uneven. *Dermal membrane* thin, delicate, transparent, rather loosely attached to the underlying tissues. *Oscula* (?). *Pores*, very abundant rounded openings through the thin dermal membrane, of various sizes.

Skeleton.—(*a*) *Dermal;* represented only by sparse, radiating brushes of spicules with outwardly projecting points. (*b*) *Main;* a rectangularly meshed reticulation of stout spiculo-fibre with primary and secondary lines distinct. Fibre containing a very large amount of spongin and few spicules.

Spicules.—(*a*) *Megasclera;* long but very slender styli, sometimes tending to become tylostylote, sharply pointed; size about 0·25 by 0·005 mm. (*b*) *Microsclera;* very minute, very slender isochelæ, very scarce, found in the dermal membrane, seen only in side view; length about 0·01 mm. Owing to their great slenderness these spicules are very difficult to make out; they give one the impression of being on the verge of disappearance. They become visible after prolonged soaking in Canada balsam.

The most remarkable feature about this sponge is the very strong development of spongin, which gives it quite a Chalinine appearance. It forms a very good instance of the manner in which horny fibre may be developed in any genus.

Locality.—Honolulu, 16 to 20 fathoms. Two pieces.

Esperiopsis pulchella, Ridley and Dendy (Pl. XIX. figs. 9, 9′, 9*a*, 9*b*, 9*c*, 9*d*; Pl. XXX. fig. 3, *e*).

1886. *Esperiopsis* (?) *pulchella*, Ridley and Dendy, Ann. and Mag. Nat., ser. 5, vol. xviii. p. 341.

Under the above name we propose to describe a very small, encrusting sponge from Station 192. The sponge occurs in very small and excessively thin patches of a blackish

colour, growing upon *Myxilla paucispinata*, nobis. These patches present a fairly even surface, but are marked with minute oval spots of a much lighter colour; these spots at first sight look like pits in the surface, but on minute examination each is found to be caused by the presence of a subdermal cavity covered over by a very thin *dermal membrane* pierced with numerous *pores;* the pores are thus arranged in definite pore-areas, each of which is about 0·45 mm. in diameter. The pores themselves are oval openings about 0·07 mm. in diameter, reducing the dermal membrane in the pore-areas to a mere network. The dermal membrane and also the deeper parts of the sponge are heavily loaded with very numerous, minute, round cells of a blackish-green colour, each about 0·004 mm. in diameter; it is to these cells that the dark colour of the sponge is undoubtedly due. *Oscula* not observed, possibly some of the pores mentioned are exhalent openings.

Skeleton.—Consisting of brushes or wisps of small stylote spicules running more or less vertically from the base to the surface of the sponge.

Spicules.—(*a*) *Megasclera;* smooth, straight styli or subtylostyli (Pl. XIX. figs. 9, 9′), sharply but only fairly gradually pointed, and usually with several slight bulbous inflations along the shaft (polytylote); size about 0·3 by 0·0063 mm. (*b*) *Microsclera;* these constitute by far the most noteworthy and characteristic feature of the species, being of extraordinary size and of equally remarkable and very beautiful form. They are isochelæ, and as the shape is sufficiently illustrated by the figures (Pl. XIX. figs. 9*a*, 9*b*) we shall not enter into a description of it in this place; the full-grown spicule measures about 0·1 mm. in length. In addition to these there are numerous much smaller spicules of rather different shape (Pl. XIX. fig. 9*c*), being a great deal shorter and much broader in proportion to their length; length commonly about 0·044 mm. Still smaller ones (Pl. XIX. fig. 9*d*) occur, which look just like the minute, slender isochelæ of the ordinary "*Amphilectus*" type; length about 0·015 mm. Although it is quite possible that there may be here at least two different kinds of microsclera, yet we are inclined to regard the two smaller forms as young stages of the large one. If this view be correct, then, from the absence of a complete series of intermediate sizes, we must conclude that the microsclera are produced periodically in batches.

The chief points of interest in this sponge concern its microsclera and their large size, especially when compared with the small size of the megasclera. It must, however, be borne in mind that the specimens may be merely young, encrusting stages of some sponge of which the adult is yet unknown. It will be seen by comparison of fig. 9, &c., Pl. XIX., with fig. 8, &c., Pl. XXIII., that *Phelloderma radiatum*, nobis, comes very close to the present species as regards spiculation; it is possible that *Esperiopsis pulchella* is a young form of some species of *Phelloderma*, but there is not sufficient evidence to justify us in placing it in that genus.

Locality.—Station 192, September 26, 1874; lat. 5° 49′ 15″ S., long. 132° 14′ 15″ E.; south-west of New Guinea; depth, 140 fathoms; bottom, blue mud.

Genus *Cladorhiza*, M. Sars (Pls. XX., XXI.).

1872. *Cladorhiza*, M. Sars, Remarkable Forms of Animal Life from the great deeps off the Norwegian Coast, pt. i. p. 65.

Sponge of varying, but usually symmetrical external form. Skeleton usually consisting of a central, erect axis of spiculo-fibre, which may or may not be branched, and from which arise longer or shorter processes also composed of spiculo-fibre. Spicules.—(*a*) *Megasclera;* chiefly stylote and often attaining a great length. (*b*) *Microsclera;* anisochelæ, characteristically with three or more claw-like teeth at each end and with a curved shaft expanded laterally into wing-like processes, which are especially developed near the larger end of the spicule. Sigmata may be present.

The genus was first characterised as follows:—"Spongia silicea ramosa, fasciculis densis spiculorum acuformium axem solidam formantibus sustentata, radiculis numerosis arborescentibus ex spiculis ejusdem generis formatis in limo affixa. Parenchyma axem internam corticis instar circumdans spiculis superficialibus anchoratis et bihamatis ornatum. Oscula et pori nulla. Ova in apicibus dilatatis ramorum se evolventia" (Sars, *loc. cit.*). This diagnosis, drawn up for but a single species, may now be emended as above.

Schmidt[1] includes in the genus also those forms which have isochelate microsclera. It has, however, seemed preferable to us to retain the name *Chondrocladia*, originally proposed by Wyville Thomson for his *Chondrocladia virgata*, for the species with isochelæ, and to confine the name *Cladorhiza* to those with anisochelate microsclera. The two genera thus distinguished are undoubtedly very closely allied, as may be seen by the arrangement and form of the spicules.

Although the different species of *Cladorhiza* vary very much in external form, yet the different modifications of the main skeleton, upon which the external form of the sponge depends, are easily derivable from one common primary type, and afford interesting instances of adaptation.

In its simplest condition the main skeleton consists of a straight, slender axis of spiculo-fibre, from which short spicular processes (or pinnæ) proceed in all directions. *Cladorhiza abyssicola*, var. *rectangularis*, nobis (Pl. XX. fig. 10), still retains almost this primitive type of skeleton, which in other species and varieties becomes very variously modified. In *Cladorhiza pennatula*, Schmidt,[2] the pinnæ are borne only on two opposite sides. In the typical *Cladorhiza abyssicola*, Sars, the main axis becomes branched; this may take place both above and below, giving rise to branches in the one case and to anchoring rootlets in the other. The pinnæ may be confined to a certain part of the stem only, where they attain a great development. A good example of

[1] *Jahresb. Comm. Wiss. Untersuch. d. deutsch. Meere*, &c.

[2] *Jahresb. Comm. Wiss. Untersuch. d. deutsch. Meere*, Jahrg. i., ii. p. 119, pl. i. figs. 14–16.

this is afforded by *Cladorhiza moruliformis*, nobis, in which the pinnæ are placed close together near the top of the main axis (*vide* woodcut, Fig. 1); being all of the same length, and radiating in every direction, while the soft tissues of the sponge occupy the spaces between them, they give rise to a spherical head perched on the end of a stalk.

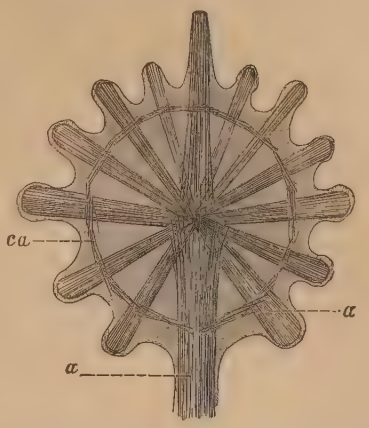


Fig. 1.—*Cladorhiza moruliformis.* Longitudinal section of the head showing the arrangement of the skeleton; *a*, axis of stem and radial bands of fibres; *ca*, capsule of loosely disposed spicules. × 4.

But by far the most remarkable of the modifications which the main skeleton thus undergoes are exhibited in the various species which we have called "*Crinorhiza*" forms[1] (*vide* woodcut, Fig. 2). When this remarkable adaptive form is present in its most typical condition we have the central axis represented by a stiff, straight, tapering root; the bulk of the soft parts are condensed into a small subglobular or cap-shaped "body," while the pinnæ are very long and slender, and are arranged in a single whorl close to the top of the axis; these long processes are very numerous and radiate in all directions, extending far beyond the body of the sponge; they are directed outwards and downwards, and their function is doubtless to prevent the sponge from sinking into the soft mud on which it lies, for which purpose they are admirably adapted.

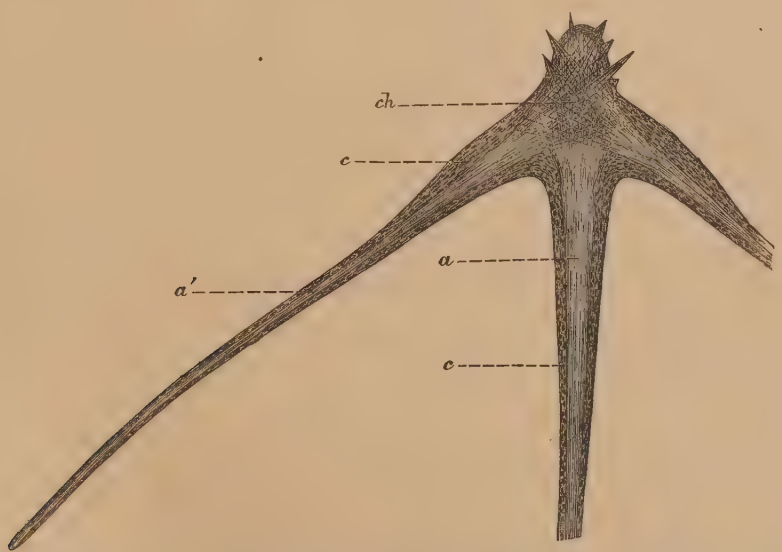


Fig. 2.—*Axoniderma mirabile.* Vertical section, showing the skeleton arrangement in a typical "*Crinorhiza*" form; *a*, axis of stem; *a'*, axis of supporting processes; *c*, cortical layer of amphiasters; *ch*, choanosome (?). × 5.

The *Crinorhiza* forms appear to be without oscula and pores, nor have we succeeded in finding flagellated chambers, although some of the specimens were in very fair

[1] *Ann. and Mag. Nat. Hist.*, ser. 5, vol. xviii. p. 342.

condition. It seems just possible, therefore, that, as originally suggested by Sars[1] in the case of the first known species of the genus, *Cladorhiza abyssicola*, these sponges have some method of obtaining their supplies of nutriment which is quite different from that found in other sponges; this is, however, extremely unlikely.

As regards the genus *Crinorhiza* itself we are necessarily in doubt. It was founded by Schmidt, and all that he wrote about it is contained in the five lines in which he describes his *Crinorhiza amphactis*.[2] The description is too short to be of much service for identification, but inasmuch as he mentions and figures an osculum at the summit of the sponge we are quite satisfied that none of our forms are specifically identical with his. The external resemblance is however striking, and while the genus *Crinorhiza* will probably have to be abolished, we gladly make use of the name for that particular external form. In this course we are supported by the example in cognate circumstances of Haeckel in the case of the Calcarea, and of Smitt and Hincks in that of the Polyzoa. Indeed, the existence of well-marked external forms running through different genera has already been thoroughly recognised in Haeckel's classical work Die Kalkschwämme, and lies at the foundation of the new departure in Polyzoan classification taken by the authors we have named.

Crinorhiza forms also occur in the closely allied genus *Chondrocladia*, Wyv. Thomson, and in the still more closely allied genus *Axoniderma*, nobis, but to these cases we shall recur later on. They certainly have a very wide geographical range, for the Challenger brought home species of *Cladorhiza*, having this form from the North Pacific (2385 fathoms; bottom, red clay); the South Pacific (3000 fathoms; bottom, red clay); and the South Atlantic (2200 fathoms; bottom, Globigerina ooze); as will be found fully recorded under the various species.

The geographical distribution of the genus is now known to be very wide, and includes the North and South Atlantic, the Southern Ocean and the North and South Pacific.

The *Cladorhizæ* are essentially deep-sea sponges, and are not unfrequently obtained at depths of between 2000 and 3000 fathoms, and they afford some of the most striking examples known of the symmetry and beauty which characterise Monaxonida living in very deep water.

Cladorhiza abyssicola, Sars, var. *rectangularis*, nov. (Pl. XX. fig. 10).

1872. *Cladorhiza abyssicola*, Sars, Remarkable Forms of Animal Life from the great deeps off the Norwegian Coast, pt. i. p. 65.

Sponge (Pl. XX. fig. 10) consisting of a straight, slender, cylindrical stem, unbranched; terminating above in a rounded extremity and below in several delicate, forking rootlets. Length of stem 50 mm.; diameter 1 mm.; greatest length of roots 25 mm. All the way up the stem, coming off at right angles, from four sides, arise

[1] Remarkable Forms of Animal Life, pt. i. p. 68.

[2] Spong. Meerb. von Mexico, pt. ii. p. 83.

numerous, long, slender, hair-like processes, broadest at the base, where they join the stem. They are arranged very regularly in four rows, so as to lie in two vertical planes which intersect each other at right angles. The interval between each two successive processes in a row is about 1·5 mm.; the processes themselves may attain the great length of 17 mm. *Colour* in spirit pale yellowish.

Skeleton.—A stout axis of spiculo-fibre runs through the stem, branching to form the roots and giving off above the hair-like processes (pinnæ).

Spicules.—(*a*) *Megasclera;* smooth, slender styli, broadest in the middle and tapering rather abruptly to a fairly sharp point at the apex. They may reach the great length of over 2 mm., and have a diameter of about 0·019 mm. Their length, however, varies much, and is generally less than that given. They are very firmly bound together in fibres, and it is difficult to get one separate for purposes of measurement. (*b*) *Microsclera;* of two kinds; (1) anisochelæ, with long, curved shaft and very unequal, claw-like extremities; they are very small, measuring about 0·025 mm. in length, and closely resemble those figured by Sars[1]; (2) rather large, smooth, simple sigmata, measuring about 0·13 by 0·007 mm.

The anatomy of the soft parts of this remarkable species has always been a mystery and must still remain so, for unfortunately the only specimen obtained by the Challenger was found dried up when we came to describe it. It will be seen that, as regards external form, the Challenger variety differs very considerably from those described and figured by Sars.[2] It also differs widely in appearance from the "Porcupine" specimens, now in the British Museum. It resembles in slenderness and delicacy *Cladorhiza pennatula*, Schmidt,[3] which has, however, the lateral pinnæ developed only in *one* plane. Two remarkable features about this sponge are the very great depth at which it occurs and the locality; Sars[4] says:—"I have only found this remarkable sponge in one single locality, namely at the fishing station Skraaven in Lofoten at the great depth of 300 fathoms on soft clay bottom"; whereas the Challenger variety comes from a depth of 2750 fathoms, in the middle of the Pacific Ocean. The "Porcupine" specimens were obtained between Scotland and the Færöe Islands, Schmidt's in the Skagerrack, and Hansen's (those of which the localities were preserved) either between Norway and the Færöe Islands, or near the west coast of Spitzbergen, one of these stations having a depth of 1215 fathoms; but uncertainty overhangs the identifications of the species by both these authors (*e.g.*, Hansen perhaps includes Carter's so-called variety *corticocancellata*, which may probably be regarded as a distinct species).

Locality.—Station 274, September 11, 1875; lat. 7° 25′ S., long. 152° 15′ W.;

[1] Remarkable Forms of Animal Life, pt. i. pl. vi. figs. 31, 32, *a*.

[2] *Loc. cit.*, figs. 16, 17.

[3] *Jahresb. Comm. Wiss. Untersuch. d. deutsch. Meere*, Jahrg. i., ii., p. 119, pl. i. figs. 14–16.

[4] *Loc. cit.*, p. 68.

Mid-Pacific; depth, 2750 fathoms; bottom, Radiolarian ooze; bottom temperature, 35°·1. One specimen.

Cladorhiza abyssicola, Sars, var. *linearis*, nov. (Pl. XX. fig. 6; Pl. XXI. figs. 2, 2*a*).

Under this name we include three denuded skeletons of a *Cladorhiza* (Pl. XX. fig. 6) obtained in the South Pacific at a depth of 2385 fathoms. Each consists of a long, straight, slender spicular axis about 106 mm. in length, with a few remaining short tufts of spicules projecting from it in places; entangled in some of these tufts are a few microsclera, the size and shape of which induce us for the present to consider the three specimens as a variety of *Cladorhiza abyssicola*, Sars, though very probably the examination of more perfect specimens may ultimately show them to be specifically distinct, or more nearly allied to *Esperella biserialis*, nobis, from the same station.

The anisochelate spicules are of fair size and have a strongly curved shaft, expanded towards the large end, and with only three short teeth at each extremity; they measure about 0·032 mm. in length.

The sigmata are large, apparently not contort, measuring about 0·17 by 0·01 mm.

The megasclera (Pl. XXI. figs. 2, 2*a*) are long, slender styli of very beautiful shape, much resembling those of *Esperella biserialis*, but the short tylostyli of the latter are not present. In the stem the styli may attain a length of nearly 3 mm.

Locality.—Station 281, October 6, 1875; lat. 22° 21′ S., long. 150° 17′ W.; South Pacific; depth, 2385 fathoms; bottom, red clay; bottom temperature, 34°·9.

Cladorhiza moruliformis, Ridley and Dendy (Pl. XX. fig. 3; Pl. XXI. figs. 1, 15, 19).

1886. *Cladorrhiza moruliformis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 342.

Sponge (Pl. XX. fig. 3) consisting of a small, globular head, perched on the summit of a stalk. A large number of short, stout, conical processes, all of about the same size, arise from the head in every direction, giving to it the appearance of a mulberry (whence the specific name). The main stalk, or axis of the sponge, is prolonged through the head, and projects for a short distance vertically above it (*vide* woodcut, Fig. 3). Diameter of the head, exclusive of the conical processes, 10 mm. Length of conical processes 2 mm.; transverse diameter of same 1 mm. Length of stalk still attached to the head (it has evidently been broken off short) 2 mm.; diameter of same 2 mm. Length of part of axis projecting above the head 2·5 mm. *Colour*, when dried, white. *Texture* fragile.

Skeleton.—(1) A main axis of spiculo-fibre is continued from the stalk, of which it forms the chief part (if not the whole), right through the globular head, projecting for a short way beyond the top of the sponge. (2) From this stalk, starting from near

the centre of the head, radiate a large number of dense, stout spiculo-fibres (Fig. 3, *a*); each runs out to the surface of the sponge and is continued to the end of one of the conical processes already mentioned. Each conical process is thus supported by an axial fibre. (3) At about one-third of the distance between the surface and the centre of the head is a reticulate layer of megasclera, which forms a kind of capsule (Fig. 3, *ca*), dividing the soft parts of the sponge into an inner and an outer portion. This capsule is, of course, pierced in numerous places by the stout radiating fibres already mentioned.

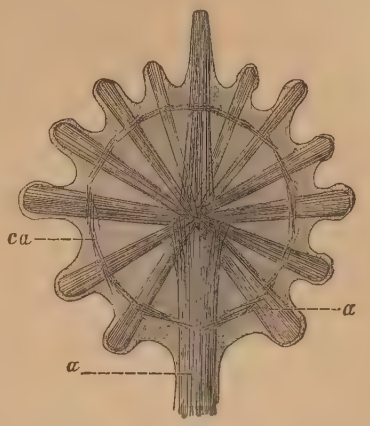


Fig. 3.—*Cladorhiza moruliformis.* Longitudinal section of the head, showing the arrangement of the skeleton; *a*, axis of stem and radial bands of fibres; *ca*, capsule of loosely disposed spicules. × 4.

Spicules.—(*a*) *Megasclera;* long, slender, very straight styli (Pl. XXI. fig. 1), which may reach a length of over 2 mm.; diameter about 0·05 mm. They are broadest in the centre and taper gradually towards each end, are flatly rounded at the base and hastately pointed at the apex. (*b*) *Microsclera;* (1) anisochelæ (Pl. XXI. fig. 19), of moderate size, length 0·063 mm.; these spicules have a slightly curved shaft, much expanded laterally towards the large end; the ends are of very unequal size and each has three sharp, prominent teeth. (2) Large, very sharply pointed, contort sigmata (Pl. XXI. fig 15), measuring up to 0·35 by 0·0145 mm.

The anisochelate spicules are especially abundant in the small conical processes, forming a dense crust around the axial fibre, with their large ends directed outwards. They are also very abundant in the tissues both inside and outside the "capsule." The sigmata appear to be very much more abundant outside the "capsule" than inside it.

Unfortunately this sponge was dry when the bladder was removed from its bottle, and we have therefore been obliged to confine our observations to the arrangement of the hard parts. It is a form of the very greatest interest, and affords a good example of radial symmetry in a Monaxonid sponge. It was a question with us whether or not this species should form the type of a new genus, but we finally decided not, as no essential changes are necessary to derive it from the more typical species, such as *Cladorhiza abyssicola*, Sars. Imagine an unbranched *Cladorhiza abyssicola* in which the points of attachment of the lateral pinnæ to the axis come close together; if the pinnæ are all of the same length the sponge will then have a globular form, and little further change is needed to convert it into *Cladorhiza moruliformis.* The chief difficulty is the capsule, and this is not an insuperable one. In some of the "Porcupine" *Cladorhiza's* (viz., *Cladorhiza abyssicola*, var. *corticocancellata*, Carter), there is an irregularly reticulate skeleton, chiefly placed at some distance beneath the surface, between the main radial fibres, and if we imagine this to become concentrated into one

definite layer, at a little depth beneath the surface, we arrive at the condition of *Cladorhiza moruliformis.*

It is, of course, by no means impossible that perfect specimens of *Cladorhiza moruliformis* may have a branching stem with a head at the end of each branch; this remains to be seen. In spiculation it agrees very closely with other species of the genus.

Locality.—Station 157, March 3, 1874; lat. 53° 55′ S., long. 108° 35′ E.; Southern Ocean, south-west of Australia; depth, 1950 fathoms; bottom, Diatom ooze; bottom temperature, 32°·1. One specimen.

Cladorhiza longipinna, Ridley and Dendy (Pl. XX. fig. 2; Pl. XXI. figs. 4, 21).

1886. *Cladorrhiza longipinna,* Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 342.

This sponge (Pl. XX. fig. 2) has acquired the "*Crinorhiza*" form. It is composed of an almost globular body, somewhat flattened on the lower surface, and also, though over a less area, on the upper surface. The circumference of the flattened lower surface is fringed with very long, fine, supporting processes, twenty-five or thirty in number, projecting outwards and downwards, while a circlet of very short, stiff, stumpy processes crowns the summit of the head. From the centre of the lower surface depends a long, rather stout, slightly tapering root or stem. Diameter of head 5 mm. Length of root 27 mm. Average length of supporting processes 19 mm. *Colour* in spirit pale yellow. *Dermal membrane* distinct, transparent.

Skeleton.—Arranged in the usual "*Crinorhiza*" form; *i.e.*, bands of spiculo-fibre form the axes of the various processes given off from the body; these are composed of the usual, long, fusiform, stylote spicules.

Spicules.—(*a*) *Megasclera;* fusiform styli, reaching over 3 mm. in length by about 0·05 mm. thick, and usually much blunted at the apices. Very numerous smaller styli also occur scattered about in the soft parts of the sponge, both in the dermal membrane and in the deeper tissues; these spicules vary greatly in size (measuring say about 1·0 by 0·015 mm.). Sometimes they show a tendency towards the development of heads, but it is very rarely that these are developed to the extent shown in the figure (Pl. XXI. fig. 4), which has been unfortunately chosen. They differ from the larger styli in being much more sharply pointed, but it would probably not be difficult to pick out an intermediate series both in shape and size. (*b*) *Microsclera;* we have found only anisochelæ (Pl. XXI. fig. 21); these are of the usual *Cladorhiza* form, but on the lower surface of the sponge attain an unusually large size. Length from 0·034 to 0·06 mm. (on the lower surface of the sponge).

The species may be recognised by the shape of the body, the great length of the supporting processes and the presence of a second circle of short processes around the

summit. The scattered tylostylote spicules of *Cladorhiza similis* and *Cladorhiza inversa* are replaced by styli.

Imbedded in the lower surface of the sponge was a large, spherical, hard, brown body; probably some parasite, perhaps encysted. This illustrates well the protective use of the dense external armour present in *Axoniderma mirabile*, nobis, and absent in this species.

Locality.—Station 264, August 23, 1875; lat. 14° 19′ N., long. 152° 37′ W.; North Pacific Ocean; depth, 3000 fathoms; bottom, red clay; bottom temperature, 35°·2. One specimen.

Cladorhiza similis, Ridley and Dendy (Pl. XX. fig. 7; Pl. XXI. figs. 5, 5*a*, 5*b*, 18).

1886. *Cladorrhiza similis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 343.

The sponge (Pl. XX. fig. 7) has assumed the "*Crinorhiza*" form, and consists of a cap-shaped, conical head, perched on the end of a stem or root, which appears to have been broken off short, so that its proper length cannot be ascertained. From the margin of the cap project a considerable number of long spicular processes, radiating outwards and downwards. The apex of the sponge is pointed, and apparently devoid of short spicular processes. The lower surface is shallowly concave, and only just 6 mm. in diameter. *Colour* in spirit dirty yellow.

Skeleton.—Arranged as usual in "*Crinorhiza*" forms.

Spicules.—(*a*) *Megasclera;* (1) very long, slender styli of the usual type; (2) short, fusiform tylostyli (Pl. XXI. figs. 5, 5*a*, 5*b*), with peculiarly shaped heads; usually very sharply pointed, and with the head and neck inclined at an angle to the main shaft. These spicules vary greatly in size, measuring from 0·21 to 0·6 mm. in length, usual thickness about 0·0157 mm. They occur chiefly scattered about near the surface of the sponge, where they are very thickly placed, and apparently represent in function the large, five-toothed, special protective spicules of *Axoniderma mirabile*. They are also found in the skeleton-fibres. (*b*) *Microsclera;* we have seen only the anisochelæ, but in our anxiety not to destroy such a unique and so small a specimen, it is not improbable that we have overlooked the sigmata. The anisochela (Pl. XXI. fig. 18) is of the usual *Cladorhiza* type. The shaft is curved and much expanded laterally towards the larger end, and there are three teeth at each extremity. Length about 0·03 mm.

It will be seen from the foregoing description that, as regards external appearance, this species comes very close indeed to *Axoniderma mirabile*, nobis; it differs, however, in the replacement of the additional microsclera, so characteristic of the latter, by small tylostyli, and also in the absence, if they be really absent, of the sigmata. The anisochelæ are, however, almost identical both as regards shape and size in the two species.

Locality.—Station 281, October 6, 1875; lat. 22° 21′ S., long. 150° 17′ W.; South Pacific; depth, 2385 fathoms; bottom, red clay; bottom temperature, 34°·9. One specimen in moderately good condition.

Cladorhiza inversa, Ridley and Dendy (Pl. XX. fig. 8; Pl. XXI. fig. 13).

1886. *Cladorrhiza inversa*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 343.

Sponge (Pl. XX. fig. 8) of the "*Crinorhiza*" form, consisting of a very small, conical head, produced upwards into a long, slender, tapering process. The base of the cone is nearly flat and faces downwards, and from its circumference there project outwards and downwards sixteen rather short, stiff, radiating processes. From near the centre of the lower (flat) surface of the sponge a single very short, stiff process projects, which is probably a downward prolongation of the main spicular axis, representing, in a much reduced condition, the usual "*Crinorhiza*" root or stem, while the main axis is developed to an unusual extent above. Diameter of base of cone 3 mm. *Colour* in spirit yellow. *Surface* even.

Skeleton.—The main skeleton consists, as usual, of a number of bands of spiculo-fibre, forming the axes of the various processes given off from the main mass.

Spicules.—(*a*) *Megasclera;* long slender styli, bluntly pointed and gradually swelling out towards the centre; size about 2·0 by 0·037 mm. (there is, however, a wide range of variation). In addition to these, which form the main skeleton, there are present a considerable number of loose tylostylote spicules. These are thickest in the middle, have a club-shaped head, and taper rather suddenly to a sharp point at the apex; size about 0·63 by 0·019 mm. (*b*) *Microsclera;* (1) anisochelæ (Pl. XXI. fig. 13), of the ordinary *Cladorhiza* type; with three teeth at each end and a curved shaft very much expanded, especially near the large end; length about 0·03 mm. (2) Sigmata (?). The anisochelæ are exceedingly abundant; on the radiating process they are arranged close together round the spicular axis with their larger ends pointing outwards. This appears to be a very common mode of arrangement in the genus.[1]

The most remarkable feature about this species concerns its external form; compared with other known "*Crinorhiza*" forms it appears to be upside down;[2] nor can we be certain that the surface which we have called "lower" in the description is not really the upper, and *vice versâ*. Having regard, however, to the function of the long radiating processes—which is, without doubt, to support the sponge in the soft mud on which it lies—we see that this would be best effected if the sponge lived in the position we have assigned to it. We must imagine, then, that this sponge agrees with its relatives in the shape of the conical head and the arrangement of the supporting processes, but that the main axis is developed in an upward instead of a downward direction; being barely represented below, while in most cases it is barely represented above.

[1] *Cf.* Sars, Remarkable Forms of Animal Life, pt. 1. p. 67.

[2] *Cf.*, however, *Chondrocladia crinita* (p. 101), which makes an approach to this condition.

As regards spiculation, it will be seen that the species agrees fairly closely with *Cladorhiza similis*, nobis, though the localities from which the two species were obtained are very widely separated.

Locality.—Station 332, March 10, 1876; lat. 37° 29′ S., long. 27° 31′ W.; South Atlantic; depth, 2200 fathoms; bottom, Globigerina ooze; bottom temperature, 34°·0. One specimen, in good condition.

Cladorhiza (*?*) *tridentata*, Ridley and Dendy (Pl. XX. figs. 9, 9*a*; Pl. XXI. figs. 16, 20).

1886. *Cladorrhiza tridentata*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 343.

Sponge (Pl. XX. figs. 9, 9*a*, and woodcut Fig. 4) small, invertedly dome-shaped. Upper surface circular, concave, with slightly inwardly turned margin; lower surface convex; may be attached. Height 6 mm.; diameter of upper surface 12 mm. *Colour* in spirit pale greyish-yellow. *Texture* soft and yielding. Lower *surface* even but minutely hispid. Upper *surface* even and smooth. *Dermal membrane* most distinct over the smooth upper surface. (Until we found the specimen figured in the woodcut, which, being attached to a stone, gives the true position of the sponge, we thought that the convex surface was the upper one, hence the position given in Pl. XX. fig. 9*a* should be inverted; when it was drawn the attached specimen was missing.)

Fig. 4.—*Cladorhiza* (*?*) *tridentata*. Specimen attached to a stone, showing the natural position of the sponge; *a*, globular bodies of unknown function. × 2.

Skeleton.—(*a*) *Dermal;* a very loose and irregular reticulation of megasclera. (*b*) *Main;* with no distinct fibre, a very loose and irregular reticulation of spicules. Very numerous spicules project more or less vertically outwards from the lower surface of the sponge for a considerable part of their length, giving to it its hispid character.

Spicules.—(*a*) *Megasclera;* of one kind only, viz., long and very slender tylostyli, with only very small heads; broadest in the middle and tapering very gradually to a very fine point at the apex; size about 0·7 by 0·0155 mm. (*b*) *Microsclera;* (1) Large, tridentate anisochelæ of very characteristic form (Pl. XXI. fig. 20), with three stout, sharp teeth at each end, deeply separated from one another; the shaft of the spicule is curved, with large, expanded, wing-like, lateral processes, tapering off from the large end downwards. Length of spicule about 0·076 mm. These chelate spicules are especially abundant in the dermal membrane on the top of the sponge, forming in places an almost continuous layer. (2) Slender sigmata (Pl. XXI. fig. 16), frequently more or less contort, measuring about 0·09 by 0·0032 mm.

In external appearance this species at first sight closely resembles *Esperella mammiformis*, and as it comes from the same station one is liable to confuse the two before examining them microscopically. It really bears some resemblance to a typical *Esperella* in having heads to the megasclera. The resemblance, however, does not go much further. We have seen that there is no definite skeleton fibre such as exists in *Esperella mammiformis*, although the surface is hispid. The chelate spicule also differs much from that of an *Esperella* in not being properly palmate and in having a widely expanded shaft, both these features being very characteristic of *Cladorhiza*.

Imbedded in the soft tissues of the sponge all around the margin, and at fairly regular intervals from one another, are a number of small, round, yellow bodies (Fig. 4, *a*, and Pl. XX. fig. 9), varying in size. Possibly they are foreign objects, but they occur in the same position in all three specimens, so this view is highly improbable. Full details concerning them will be found in the Introduction.

In the arrangement of its skeleton this sponge stands quite alone in the genus, and as this is generally such a good guide it seems very doubtful whether it ought to be admitted as a *Cladorhiza;* but for the sake of convenience we shall retain it here for the present, placing it at the end as a doubtful species.

Only three examples were obtained, one of which represents only half of the sponge, while another is damaged on the lower surface, having evidently been torn from its attachment. The third specimen is, however, still attached to the stone on which it grew (woodcut, Fig. 4).

Locality.—Station 147, December 30, 1873; lat. 46° 16′ S., long. 48° 27′ E.; between Prince Edward Island and Crozet Island; depth, 1600 fathoms; bottom, Diatom ooze; bottom temperature, 34°·2. Three specimens.

Genus *Axoniderma*,[1] Ridley and Dendy (Pls. XX., XXI.).

1886. *Trochoderma*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 344.
1886. *Axoniderma*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 493.

Megasclera stylote to tylostylote. Microsclera anisochelæ of the *Cladorhiza* type, to which may be added sigmata. In addition to these spicules there is also present another form, peculiar to the genus. These may, for the present, be classed as microsclera. They are amphiasters, consisting each of a long, cylindrical shaft with five equal teeth arranged in a star at each end (Pl. XXI. fig. 9).

This genus is probably descended from a "*Crinorhiza*" form of a *Cladorhiza*, which, as a protection against parasites and other enemies, has acquired an additional kind of

[1] From Greek ἄξων, a wheel, and δέρμα, the skin. We are indebted to Professor F. J. Bell for pointing out to us that the name *Trochoderma* was already in use for a genus of Echinoderms, so we have altered the name while endeavouring to retain the meaning.

spicule, the amphiaster; the additional spicules being arranged in a dense external layer. Or, on the other hand, it may have been derived from a genus of sponges, characterised by the presence of an amphiaster, which, having taken to deep water and a soft bottom, has acquired the "*Crinorhiza*" form independently. In any case the genus seems to be very nearly related to *Cladorhiza*, standing to it in much the same relation as *Meliiderma* does to *Chondrocladia* (*vide* p. 102).

Axoniderma mirabile, Ridley and Dendy (Pl. XX. fig. 5; Pl. XXI. figs. 8, 9, 10).

1886. *Trochoderma mirabile*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 344.

1886. *Axoniderma mirabile*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 493.

Sponge (Pl. XX. fig. 5) of "*Crinorhiza*" form, consisting of a conical, cap-shaped body perched on the end of a slender stalk or root, which is inserted into the centre of the lower, concave surface of the body. The root swells out considerably just before

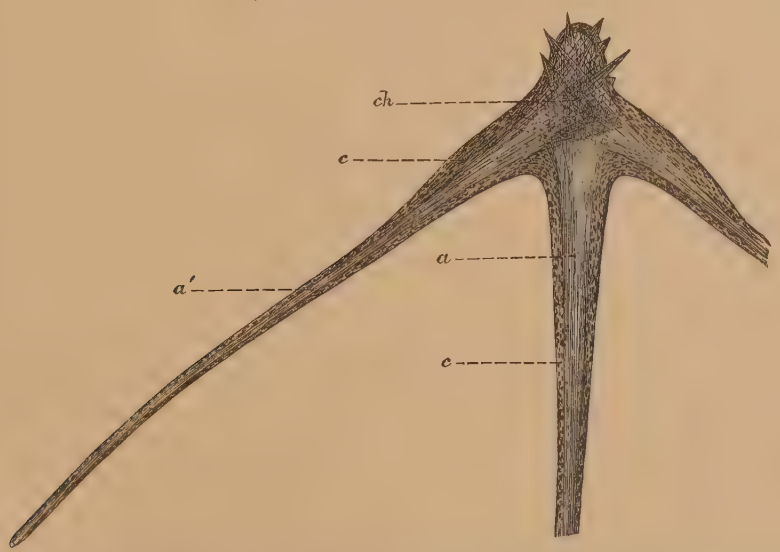


FIG. 5.—*Axoniderma mirabile*. Vertical section, showing the skeleton arrangement; *a*, axis of stem; *a'*, axis of supporting process; *c*, cortical layer of amphiasters; *ch*, choanosome (?). × 5.

its insertion into the head. From the free circular margin of the body numerous (thirty or forty) very long, filamentous, spicular processes are given off obliquely outwards and downwards. The summit of the body is produced into a papilla, from which project numerous very short and slender spicular processes. Transverse diameter of the body, from base to base of the long spicular processes, a little over 6 mm. Length of root nearly 50 mm.; it thins out to hair-like proportions at the lower end, and may very possibly have been broken off. Length of the long spicular processes

about 31 mm. *Colour* in spirit yellow. *Texture* hard and firm owing to the extraordinarily small amount of soft tissues present. *Surface* almost smooth. *Oscula* and *pores* apparently absent.

Skeleton.—A band of spiculo-fibre forms the axis of the stem or root, and is continued in a looser condition to the summit of the head, there giving rise to the short, slender, projecting, spicular processes already described, each of which is composed of a single large spicule. From the centre of the head bands of spiculo-fibre radiate outwards and downwards, giving rise to the very long spicular processes which fringe the margin of the sponge. At their origin these bands are very broad, but they rapidly taper away to hair-like thinness (*vide* woodcut, Fig. 5, *a'*).

Spicules.—(*a*) *Megasclera;* of one kind only, viz., straight, slender styli, which may attain a length of over 3·5 mm. (*b*) *Microsclera;* (1) anisochelæ (Pl. XXI. fig. 8) of the usual *Cladorhiza* type, with the curved shaft much expanded towards the larger end, and with three teeth at each extremity; length about 0·038 mm. (2) Sigmata (Pl. XXI. fig. 10), more or less contort, of fair size, and with the ends produced into long, slender, whip-like processes, much as in *Cladorhiza abyssicola*, var. *cortico-cancellata*, Carter; length of spicule (from bend to bend) about 0·0756 mm.; these spicules are rather rare. (3) Amphiasters (Pl. XXI. fig. 9), large and very remarkable spicules, each consisting of a straight shaft with a rosette of five teeth at each end; these spicules vary considerably in size, reaching about 0·23 mm. in length. They form a very thick, dense layer (*vide* woodcut, Fig. 5, *c*), encrusting the entire body, both upper and lower surfaces, and the upper portions of the root and of the long radiating processes. They are confined to this external layer, in which they are very closely packed together without much order.

As regards external form this species is almost indistinguishable from a species of *Cladorhiza* obtained at Station 281, which we have called *Cladorhiza similis*, so that without microscopic examination one would at once put them down as identical; microscopic examination, however, shows the spiculation to be widely different, as will be seen by reference to the description on p. 93.

We are inclined to regard the presence of extra microsclera (if so they can be called) as a special modification introduced to suit the special requirements of the species, and hence they would be of less value in classification than the ordinary microsclera, the full complement of which is also present. The very dense external armature of spicules is doubtless a most efficient protection against the inroads of parasites or other enemies. That allied sponges are subject to such attacks will be seen by reference to the description of *Cladorhiza longipinna* (p. 93).

Locality.—Station 291, October 27, 1875; lat. 39° 13′ S., long. 118° 49′ W.; South Pacific; depth, 2250 fathoms; bottom, red clay; bottom temperature, 34°·6. Two good specimens.

Genus *Chondrocladia*, Wyville Thomson (Pls. XX., XXI.).

1873. *Chondrocladia*, Wyville Thomson, The Depths of the Sea, p. 188.
1880. *Cladorhiza* (*pars*), Schmidt, Die Spongien des Meerbusen von Mexico, pt. ii. p. 83.

Of varying, but usually symmetrical form. Skeleton usually consisting of a central, erect axis of spiculo-fibre, which may or may not be branched, and from which arise longer or shorter processes, also composed of spiculo-fibre. The chief megasclera are stylote and often attain a great length. The characteristic microsclera are isochelæ, with three or more teeth at each extremity and a curved shaft expanded laterally near each end into wing-like processes. Sigmata may also be present.

The genus was founded in 1873 by Sir Wyville Thomson (*loc. cit.*) for his *Chondrocladia virgata;* but he gives no generic diagnosis.

The two genera *Chondrocladia*, Wyville Thomson, and *Cladorhiza*, M. Sars, appear to be closely allied, differing only in the form of the chelæ, which in the one case have the two ends unequal and in the other equal, and, as already pointed out (p. 86), Schmidt includes both under the name *Cladorhiza*.

The *Chondrocladiæ* are also deep-sea sponges, and may acquire the "*Crinorhiza*" form; they are not nearly so well represented in the collection as is the genus *Cladorhiza*.

The geographical distribution of the genus is extended by the results of the Challenger voyage from the North Atlantic to the Southern Ocean and the Pacific, and the vertical distribution to nearly 3000 fathoms.

Chondrocladia concrescens (?), Schmidt, sp. (Pl. XX. fig. 12; Pl. XXI. figs. 7, 7*a*, 12).

1880. *Cladorhiza concrescens*, Schmidt, Die Spongien des Meerbusen von Mexico, pt. ii. p. 83, pl. x. figs. 8, 9.

Want of evidence, due both to the fragmentary nature of the Challenger specimens and to the incompleteness of Schmidt's original account, makes the identification of this species doubtful.

The Challenger specimens (Pl. XX. fig. 12) consist of five stalks, four of which have their ends inserted into sockets in a thick, fleshy mass strongly resembling mammalian hyaline cartilage in appearance, while their other ends are free. The fifth stalk is separate from the others and has a lobe-like, fleshy mass adhering to one end. It is the narrower ends of the stalks which are inserted into the solid fleshy masses, while the broader ends are free, but have evidently been attached (? to the main stem) when the

sponge was living. Length of the stalks about 50 mm., with a diameter at the broad end of about 2·5 mm.

Spicules.—(*a*) *Megasclera;* slender styli (Pl. XXI. figs. 7, 7*a*), which may attain in the stalks a length of over 4·5 mm., with a diameter of about 0·07 mm. (*b*) *Microsclera;* isochelæ (Pl. XXI. fig. 12), with long shaft and six or seven teeth at each end; length about 0·094 mm. Shaft slightly expanded towards each end. The sigmata are virtually absent though two or three very slender ones were seen, measuring about 0·056 mm. in length, which may or may not be proper to the sponge. Oscar Schmidt also mentions no sigmata in his specimens (*loc. cit.*); his remarks about the shape and size of the microsclera run as follows:—"Es sind zwei Sorten von Doppelankern vorhanden. Die eine, kleinere von 0·02857 bis 0·0311 Mmtr. zeichnet sich durch unverhältnissmässig lange Zähne aus, deren Enden sich fast berühren. Noch eigenthümlicher ist die andere, besonders grosse, von 0·07142 bis 0·12 Mmtr. Sie besitzt nämlich keinen Mittelzahn, sondern statt dessen ein Paar Zähne, daneben jederseits noch zwei, also im Ganzen sechs Zähne. Im Schaft, der in der Nähe der Zähne, wie so oft, mit seitlichen Ausbreitungen versehen ist, sieht man schon bei mässiger Vergrösserung den Axencanal."

Possibly the small chelæ here described are young forms of the others, we have not found any in our specimens.

Locality.—Station 248, July 5, 1875; lat. 37° 41′ N., long. 177° 4′ W.; North Pacific; depth, 2900 fathoms; bottom, red clay; bottom temperature, 35°·1. Fragments.

Chondrocladia clavata, Ridley and Dendy (Pl. XX. figs. 1, 1*a*; Pl. XXI. fig. 11).

1886. *Chondrocladia clavata*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 345.

Sponge (Pl. XX. figs. 1, 1*a*) club-shaped, consisting of a very small, globular body perched on the end of a slender stalk. From various parts of the body radiate long, slender processes. The stalk is short, and at the bottom breaks up into a tuft of rootlets. Diameter of body 2 mm.; length of stalk and rootlets 12 mm. (these measurements were taken from the smaller of two specimens). *Colour* in spirit pale yellow.

Skeleton.—The skeleton consists of a main axis of spiculo-fibre, breaking up below into a number of smaller fibres forming the rootlets, and giving off above a number of radiating fibres which project for a considerable distance beyond the body of the sponge.

Spicules.—(*a*) *Megasclera;* slender styli, sometimes slightly tylostylote, varying in length according to their position in the sponge. In the main fibre of the skeleton they measure about 1·0 by 0·022 mm.; numerous smaller ones occur scattered loosely through the soft parts of the sponge. (*b*) *Microsclera;* (1) numerous isochelæ

(Pl. XXI. fig. 11) of the usual *Chondrocladia* type, each with a curved shaft expanded towards each end and with three claw-like teeth at each extremity. Length about 0·057 mm. (2) A few sigmata, simple and contort, about 0·044 mm. long.

It will be seen that this sponge makes a near approach to the "*Crinorhiza*" form, but does not quite attain to it. It is chiefly remarkable on account of its minute size and the exceedingly small amount of soft tissues present. It was obtained in comparatively shallow water (140 fathoms), but on a bottom of mud.

Locality.—Station 174, August 3, 1874; lat. 19° 6′ 0″ S., long. 178° 14′ 20″ E.; Kandavu, Fiji Islands; depth, 140 fathoms; bottom, coral mud. Two specimens.

Chondrocladia crinita, Ridley and Dendy (Pl. XX. fig. 4; Pl. XXI. figs. 3, 17).

1886. *Chondrocladia crinita*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 345.

Sponge (Pl. XX. fig. 4), of the "*Crinorhiza*" form, consisting of a rather large, conical body, terminating above in a stout, spike-like projection, composed of spiculo-fibre. The base of the sponge is fringed by a number of long, coarse, hair-like processes, and from near its centre projects a short papilla. Diameter of body at base 15 mm.; height of body 12 mm. *Colour* in spirit brownish-yellow. *Surface* ribbed by the projection of the upper parts of the fringing processes, which are very prominent. *Dermal membrane* distinct, rather thick; containing numerous microsclera, especially isochelae, but no megasclera.

Skeleton.—Of the "*Crinorhiza*" type, consisting of a central axis of dense spiculo-fibre, forming the spike at the summit of the sponge and not developed below; with radiating bands of spiculo-fibre which form the axes of the fringing processes.

Spicules.—(*a*) *Megasclera;* slender styli (Pl. XXI. fig. 3), measuring in the main fibres about 2·2 by 0·044 mm. (*b*) *Microsclera;* (1) numerous large isochelæ (Pl. XXI. fig. 17) of the usual *Chondrocladia* form, with curved shaft expanded towards each end and three teeth at each extremity. Length about 0·1 mm. (2) Slender, more or less contort sigmata; very abundant in the dermal membrane; length about 0·07 mm.

This sponge is of especial interest on account of its having acquired the "*Crinorhiza*" form. Unfortunately only a single specimen was obtained, and that in very bad condition. On cutting it open a number of embryos were found imbedded in the soft tissues near the centre of the sponge.

Locality.—Station 216A, February 16, 1875; lat. 2° 56′ N., long. 134° 11′ E.; north of New Guinea; depth, 2000 fathoms; bottom, Globigerina ooze; bottom temperature, 35°·4. One specimen.

Genus *Meliiderma*,[1] n. gen. (Pls. XX., XXI.).

1886. *Chondrocladia* (*pars*), Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 344.

Sponge stipitate. Megasclera stylote to tylostylote. Microsclera, isochelæ of the ordinary *Chondrocladia* form, to which may be added sigmata. In addition to these forms of spicules a special protective spicule occurs encrusting the stem, each spicule consisting of a slightly expanded base of attachment, a constricted neck, and a fusiform, outwardly projecting shaft, terminating in a pointed apex (*vide* annexed woodcut, Fig. 6).

This genus stands in much the same relation to *Chondrocladia* as does *Axoniderma* to *Cladorhiza*, having, like *Axoniderma*, developed a special spicule for external defensive purposes. The form of the extra spicule is, however, totally different in the two cases; and in *Meliiderma* it appears to be confined to the stalk, while in *Axoniderma* it is most abundant in the body of the sponge. In both these cases it is very difficult to say whether the extra spicule ought to be classed amongst *megasclera* or *microsclera*; for the sake of convenience both will here be regarded as *microsclera*, though standing on quite a different footing from other microsclera. The form of the extra microsclera in *Meliiderma stipitata* is as yet unparalleled. From their resemblance to spears or darts we have derived the generic name.

Meliiderma stipitata, Ridley and Dendy (Pl. XX. fig. 11; Pl. XXI. figs. 6, 6*a*, 6*b*, 6*c*, 14).

1886. *Chondrocladia stipitata*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 344.

Sponge (Pl. XX. fig. 11) consisting of a spherical head perched on the end of a long stalk, which in the one perfect specimen is much bent. Diameter of head about 12 mm. Length of stalk in the perfect specimen, 25 mm., diameter about 2 mm. At the base the stalk terminates in a flattened expansion which is firmly attached to a fragment of black volcanic cinder. *Colour* in spirit pale yellow. *Texture* of head soft. *Surface* hispid. *Dermal membrane* fairly distinct.

Skeleton.—There is no dermal reticulation, and the main skeleton consists chiefly of a very dense band of spiculo-fibre, forming the greater part of the stem; this penetrates the spherical head for a short distance and then expands slightly into a knob-like extremity, from which radiate thin bands of loose spiculo-fibre in all directions, running vertically to the surface. Numerous spicules project for some distance beyond the surface of the sponge, giving to it its hispid appearance.

Spicules.—(*a*) *Megasclera*; of one kind only, viz., long tylostyli (Pl. XXI. figs. 6, 6*a*, 6*b*, 6*c*), often a little crooked, measuring up to 2·2 by 0·038 mm.; head, as a rule, only very slightly indicated, apex sharply pointed; the spicules are broadest in the

[1] Greek μελία, a spear, and δέρμα, the skin.

middle and taper gradually towards both ends. (*b*) *Microsclera;* (1) large isochelæ (Pl. XXI. fig. 14) with curved shaft and five prominent claw-like teeth at each end; the shaft is considerably expanded laterally near each end, but contracts again before the points of attachment of the teeth. Length of spicule about 0·085 mm. The chelate spicules are especially abundant in the dermal membrane and around the embryos. (2) Slender sigmata, often contort, measuring about 0·055 by 0·016 mm.; these spicules are comparatively scarce. (3) The spear-like spicules (*vide* woodcut annexed); these are densely packed in a single layer around the stalk, each with its apex projecting vertically outwards.

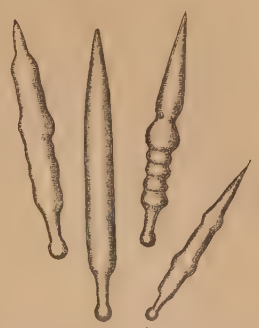


Fig. 6.—*Meliiderma stipitata.* Spicules encrusting the stem. × 400.

Only one perfect specimen of this sponge and one damaged one are in the collection; in both of these the stalk is encrusted by a thin, yellow, velvet-like layer of the densely packed, spear-like spicules. At first we thought that these spicules belonged to some foreign encrusting sponge, and hence no mention of them was made in our Preliminary Report, but subsequent examination has convinced us that they are proper to the species; the fact of their occurring in both specimens being strong evidence in favour of this view.

An interesting point about the sponge is the position in which the embryos develop. In the specimen which we cut open, a number of round yellow bodies were found, each enclosed in a membranous capsule around which the chelate spicules were lying in very great numbers. These embryos were placed in a zone of tissue occupying about the centre of the spherical head, and lying immediately above the expanded termination of the stalk, between the bands of spiculo-fibre which radiate from it; this being obviously the position of greatest security.

Locality.—Station 147, December 30, 1873; lat. 46° 16′ S., long. 48° 27′ E.; between Prince Edward Island and Crozet Island; depth, 1600 fathoms; bottom, Diatom ooze; bottom temperature, 34°·2. Two specimens.

Genus *Desmacidon*, Bowerbank (Pls. XXIII., XXIV., XXX., XLVII.).

1842. *Halichondria* (*pars*), Johnston, British Sponges, p. 88.
1864. *Desmacidon*, Bowerbank, Mon. Brit. Spong., vol. i., p. 200.

Form various. Distinct spiculo-fibre, with a large amount of uniting spongin, may or may not be present. Megasclera diactinal, oxea or strongyla; microsclera isochelæ, and, at any rate usually, sigmata.

The genus is usually made much more comprehensive than the above diagnosis would permit. It has thus become unwieldy and artificial, including forms which are much too dissimilar to be placed together. It was founded by Bowerbank, who gives the following generic diagnosis (*loc. cit.*)—"Skeleton fibrous, irregularly reticulated.

Fibres composed entirely of spicula arranged in accordance with the axis of the fibre, cemented together and thinly coated with keratode." This diagnosis is even more indefinite than that of Vosmaer, which runs as follows:—"Rods smooth or spined. Anchors bi- or tridentate, also palmato-dentate, equiended. 'Keratode-fibre' very conspicuous."[1]

Under these circumstances the only thing left for us to do was to take Bowerbank's type of the genus, viz., *Desmacidon fruticosa*, and unite with it those sponges which have a similar spiculation (as given above). We are conscious of the possibility that our diagnosis may prove to be too limited, but there can, we think, be little doubt that whatever sponges fall within its limits will form a natural group, which can scarcely be said of the two previous diagnoses.

The genus, even as above restricted, has a very wide geographical range, being found in British and Australian Seas and off the east coasts of North and South America, and, if we include the subgenus *Homœodictya*, as far south as Kerguelen Island.

Desmacidon fruticosa, Montagu, sp., var. (Pl. XXIII. figs. 10, 10*a*, 10*b*, 10*c*, 10*d*; Pl. XXX. fig. 1).

1818. *Spongia fruticosa*, Montagu, Mem. Wern. Soc. Edin., vol. ii. p. 112, pl. xiv. figs. 3, 4.
1842. *Halichondria fruticosa*, Johnston, British Sponges, p. 103.
1864. *Desmacidon fruticosa*, Bowerbank, Mon. Brit. Spong., vol. i. p. 200.

With this species we unite, as a variety, an interesting specimen from the south-east of Australia. The sponge (Pl. XXX. fig. 1) arises from a short, stout peduncle, and expands into a broad, somewhat compressed palm; its height is about 62 mm. It agrees with Bowerbank's specimens in having a distinct fibre, and, still more closely, in spiculation. The spicules are oxea (Pl. XXIII. figs. 10, 10*a*, 10*d*), tridentate isochelæ (Pl. XXIII. figs. 10*b*, 10*c*), and sigmata. The oxeote is of about the same size (about 0·25 mm. long) in both, but in the Challenger variety is perhaps not quite so abruptly pointed and without any marked inequality of the two ends such as is often visible in Bowerbank's specimens. In the Challenger variety, again, the chelæ are slightly larger and of stouter build than in the British form (measuring about 0·038 as against 0·0315 mm.), and the sigmata also appear to attain a slightly greater size (reaching up to about 0·063 mm. in length).

The surface of the sponge is scored with a few deep, broad, longitudinal grooves or channels (Pl. XXX. fig. 1), mostly confined to one side. It is doubtful whether these grooves are natural or whether they have been caused by the sponge growing up against some cylindrical, branching organism.

Locality.—Station 163A, April 4, 1874; lat. 36° 59′ S., long. 150° 20′ E.; off the south-east coast of Australia; depth, 120 fathoms; bottom, green mud. One specimen.

[1] Notes from the Leyden Museum, vol. ii., 1880, p. 130; see also Porifera, in Bronn's Klass. u. Ordnung. des Thierreichs, p. 350.

Desmacidon reptans, Ridley and Dendy (Pl. XXIII. figs. 7, 7*a*, 7*b*).

1886. *Desmacidon reptans*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 345.

Sponge encrusting, creeping over other sponges of different species, or free; massive, amorphous, or digitate. *Colour* in spirit greyish-yellow. *Texture* fairly firm, resilient. *Surface* glabrous-looking, but slightly rough to the touch, marked with shallow and for the most part longitudinal grooves. *Dermal membrane* thin and delicate. *Oscula* small, scattered. *Pores* small, scattered.

Skeleton.—(*a*) *Dermal;* varying in its degree of development according to the particular specimen examined. Sometimes it is composed of a comparatively wide-meshed reticulation of stout fibre, composed of broken spicules and foreign bodies, while the polygonal meshes of this network are again filled in by the much smaller polygonal meshes of a finer network, composed of more slender fibre, but of the same character. The meshes of the finer reticulation are only about 0·07 mm., while those of the coarser reticulation may be 0·35 mm. in diameter. The finer reticulation appears to be at a slightly higher level than the coarser one. At other times the two reticulations are not distinguishable from one another, the whole dermal skeleton is more irregular, and the foreign bodies are in great part or entirely replaced by the proper oxeote spicules of the species; while again at other times the number of foreign bodies present in the fibres may be very great, consisting chiefly of sand grains. (*b*) *Main;* an irregular, fairly close, somewhat Isodictyal reticulation of oxeote spicules, often several lying parallel side by side, but rarely united into distinct fibres.

Spicules.—(*a*) *Megasclera;* of one kind only, viz., smooth oxea (Pl. XXIII. figs. 7, 7*a*), tapering rather abruptly to a sharp point at each end; size about 0·18 by 0·008 mm. (*b*) *Microsclera;* of two kinds; (1) isochelæ (Pl. XXIII. fig. 7*b*), with three sharp teeth at each end, length about 0·019 mm., rather rare; (2) numerous simple or contort sigmata, about 0·038 mm. long.

In spiculation this species comes near to *Desmacidon fruticosa*, Montagu, sp., the type of the genus.[1] It differs, however, in the much slighter development of horny matter in the fibre, and in the much smaller size of the chelate spicule (0·032 mm. long in *Desmacidon fruticosa* as against 0·019 in *Desmacidon reptans*). The habit appears also to differ considerably.

The sponge affords a good example of the way in which foreign bodies may replace the proper skeleton, being arranged along the true skeleton lines.

Locality.—Off Bahia, shallow water; two specimens. Off Bahia; 7 to 20 fathoms; three specimens and some pieces.

[1] *Cf.* Bowerbank, Mon. Brit. Spong., vol. i. p. 200, &c.

Desmacidon conulosa, Ridley and Dendy (Pl. XXIII. figs. 5, 5*a*, 5*b*, 5*c*; Pl. XXIV. fig. 2).

1886. *Desmacidon conulosa*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 346.

Sponge (Pl. XXIV. fig. 2) consisting, in the case of the larger specimen, of a tough peduncle, expanding and dividing above into two broad, flattened, palmate lobes. Height of specimen 94 mm.; thickness of the lobes 8 mm. *Colour* in spirit greyish-yellow. *Texture* firm, tough, resilient. *Surface* rugose, owing to numerous, thickly placed conuli, which project above the dermal membrane; these are absent from the peduncle. *Dermal membrane* thin, delicate, transparent. *Pores* scattered. *Oscula* small, about 1·5 mm. in diameter, numerous, scattered on both flattened surfaces and a few along the upper margin of the sponge.

Skeleton.—Composed of a coarse reticulation of stout spiculo-fibre; the fibres being formed of the oxeote spicules with only a very small proportion of uniting horny substance. The main fibres run more or less vertically to the surface and there terminate in compact, slightly divergent tufts of spicules—the conuli above mentioned.

Spicules.—(*a*) *Megasclera;* of one kind only, viz., very stout, fusiform oxea (Pl. XXIII. figs. 5, 5*a*), tapering gradually to a very sharp point at each end. Size about 0·7 by 0·057 mm. These spicules occur loosely scattered in the soft tissues of the sponge, as well as in the fibres. (*b*) *Microsclera;* small palmate isochelæ (Pl. XXIII. figs. 5*b*, 5*c*), with large anterior palms and lateral palms only slightly developed. Length about 0·032 mm.

A great number of small, spherical, yellow embryos occur in the deeper tissues of the sponge.

This species exhibits a close relationship to *Desmacidon compressa*, Esper (Ehlers), but differs in the arrangement of the oscula, which, in *Desmacidon compressa*, are said to be large and confined to the upper margin of the sponge. In the description of *Desmacidon compressa* we find also no mention of the remarkable and very characteristic conuli present in the Challenger species. This species forms a connecting link between the more typical species of the genus and the subgenus *Homœodictya*, and in some respects comes very near to *Desmacidon* (*Homœodictya*) *grandis*, nobis (*vide* p. 111), from the same locality.

Locality.—Simon's Bay, Cape of Good Hope, 10 to 20 fathoms. One large specimen, from which the measurements given above are taken, and one small one.

Desmacidon (?) ramosa, Ridley and Dendy (Pl. XXIII. figs. 4, 4*a*, 4*b*, 4*c*; Pl. XXIV. fig. 4; Pl. XLVII. fig. 6).

1886. *Desmacidon (?) ramosa*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 346.

Sponge (Pl. XXIV. fig. 4) consisting of numerous, irregular, long, vermiform, anastomosing branches, about 6 mm. in diameter. One piece in the collection is about 212 mm. long, but there seems no reason why it should not grow to a much greater length. *Texture* tough and leathery. *Colour* in spirit pale greyish-yellow. *Surface* uneven and minutely hispid, often with a reticulate appearance. There is a distinct, tough, outer rind, which, however, adheres rather firmly to the underlying tissues. *Dermal membrane* very distinct, transparent. *Oscula* scattered up and down the branches at irregular intervals; their margins are produced into conical protuberances about 2 mm. long. On some branches the oscula are numerous, while in other parts they appear to be almost or entirely wanting. *Pores* scattered between the radiating brushes of spicules which support the dermal membrane.

Skeleton.—Of a distinctly radiate type. There is a more or less definite axis of spiculo-fibre running through each branch, from which radiate, though in no very definite manner, numerous bands of spiculo-fibre; these run towards the surface of the sponge, and on approaching it, break up into divergent tufts of spicules which support the dermal membrane and sometimes project beyond it, causing the hispidity of the surface (Pl. XLVII. fig. 6). There is no dermal reticulation.

Spicules.—(*a*) *Megasclera;* of one kind only, viz., sharp-pointed, fusiform oxea (Pl. XXIII. figs. 4, 4*a*), measuring about 0·6 by 0·022 mm. (*b*) *Microsclera;* of one kind only, viz., tridentate isochelæ (Pl. XXIII. figs. 4*b*, 4*c*), the shafts of which appear to be extended into slight lateral fimbriæ. Length about 0·02 mm.

It will be seen from the above that in spiculation this species would be really a typical *Desmacidon*, were it not for the absence of the sigmata. These, however, appear from the study of other genera to be such very variable elements in the spiculation that they cannot be considered as of generic importance. More important, indeed, is the radial arrangement of the skeleton, very different from that of other species of the genus and, indeed, of most of the family, and making a near approach to the arrangement of the skeleton in the genus *Raspailia*.

Localities.—Station 142, December 18, 1873, lat. 35° 4′ S., long. 18° 37′ E.; south of the Cape of Good Hope; depth, 150 fathoms; bottom, green sand; bottom temperature, 47°·0. Several specimens.

Off Marion Island, 50 to 75 fathoms. One specimen, of much darker (greyish) colour than the previous ones.

Subgenus *Homœodictya*, Ehlers (Pls. XXII., XXIII., XXIV., XXIX.).

1797. *Spongia* (*pars*), Esper, Die Pflanzenthiere, Fortsetz. i. p. 190, pl. l.
1842. *Halichondria* (*pars*), Johnston, British Sponges, p. 92, pl. ii.
1866. *Isodictya* (*pars*), Bowerbank, Mon. Brit. Spong., vol. ii. p. 311; vol. iii. pl. lii.
1867. „ (*pars*), Gray, Proc. Zool. Soc. Lond., May 1867, p. 534.
1870. *Homœodictya*, Ehlers, Die Esper'schen Spongien, Erlangen, 1870, p. 17.
1882. *Chalina* (*pars*), Carter, Ann. and Mag. Nat. Hist., ser. 5, vol. x. p. 111.

Form various, usually lobate or palmate. Megasclera oxea. Microsclera isochelæ, of a very peculiar type. The latter are the characteristic spicules of the subgenus; the shaft is slightly curved and may be expanded all the way along, from end to end, into continuous, delicate, lateral fimbriæ, which may be more or less curved; in other words, the two lateral palms on each side of the spicule may remain united together, and form merely terminal portions of a continuous lateral fimbria. The anterior palm of the spicule is distinct and somewhat oval in shape, usually slightly curved outwards at the free end; from the median line of the posterior surface of each anterior palm there projects backwards, *i.e.*, towards the shaft, a delicate, flat fimbria, pear-shaped in outline; this gives to the anterior palm the appearance of being forked when the spicule is viewed laterally, and is the distinguishing feature of the subgenus (*vide* Pl. XXIX. fig. 7*a*).

Although of a very peculiar form, the isochela of *Homœodictya* does not really differ so much from an ordinary isochela as might at first sight be expected. We have only to cut away the central portion of each lateral fimbria (in those cases where it persists), leaving the ends as lateral palms (connected, of course, as usual, with the shaft for their whole length), and to abolish the pear-shaped process which remains adherent to the back of the anterior palm, and probably represents the remains of a connection between the latter and the shaft, and we have left a typical palmate isochela, like that, for example, of *Desmacidon compressa*.[1]

The history of this interesting subgenus is not a little involved, and will give some idea of the literary difficulties which the spongologist has to encounter.

Johnston, in his British Sponges (p. 92, pl. ii.) describes and figures a sponge under the name *Halichondria palmata*, and gives in his list of synonyms, "Spongia palmata, *Sibb.* Scot. ill. ii. lib. iv. 55, &c." With some difficulty we found the book thus referred to,[2] but the only reference we found to sponges consists of the two words "*Spongia palmata;*" and we can hardly retain this as a synonym on so little evidence.

Bowerbank, in his Monograph of British Spongiadæ (*loc. cit.*), describes and figures his *Isodictya palmata*, which he identifies with *Halichondria palmata*, Johnston. He

[1] *Cf.* also the descriptions given by Mr. Carter of the isochela of *Homœodictya* (*Chalina*) *palmata* and of *Desmacidon compressa*, *Ann. and Mag. Nat. Hist.*, ser. 5, vol. x. p. 111, fig. 1, *a* and *b*, and p. 113.

[2] Nuncius Scoto-Britannus, sive Admonitio de Atlante Scotico &c., by Sir Robert Sibbald, Edinburgh, 1683. The book is also known as Scotia illustrata.

here for the first time describes and figures the peculiar chelate spicule, but makes no mention of such spicules in Johnston's sponge, nor does Johnston himself mention them in his original description (*loc. cit.*). Fortunately, Mr. H. J. Carter [1] has found these spicules in Johnston's type in the British Museum, and thus the identification of Bowerbank's with Johnston's species is confirmed; though Mr. Carter places them both in the genus *Chalina*. Dr. Gray in his remarkable paper in the Proceedings of the Zoological Society of London (May 1867), appears to recognise the fact (which is undoubtedly true) that Dr. Bowerbank's genus *Isodictya* is much too comprehensive; he therefore very wisely splits the genus up into several genera, but unfortunately in so doing he retains the name *Isodictya* for two of these distinct genera, giving to each a distinct generic diagnosis. With his first genus *Isodictya* (*loc. cit.*, p. 512) we have here nothing to do. Of his second (p. 534) he gives the following diagnosis. "Sponge sessile, minutely hispid, regularly reticulated. Spicules of three kinds:—1. Needle-shaped, fusiform. 2. Bihamate, bicalcarate (Bowerb., f. 121). 3. Equianchorate or palmate." Of this genus he gives *Isodictya normani*, Bowerbank, as the type, and says, "see also . . . . *I. palmata*, Bowerb." Unfortunately *Isodictya palmata*, Bowerbank, has only two kind of spicules.

Dr. Ehlers (Die Esper'schen Spongien, p. 16) identifies Esper's old species, *Spongia digitata*,[2] with Johnston's *Halichondria palmata* and Bowerbank's *Isodictya palmata*. He recognises (pp. 35, 36) that both Gray's genera *Isodictya* cannot stand, and creates for Esper's species, *digitata*, the new genus, *Homœodictya*, without, however, giving a fresh generic diagnosis, and apparently intending the new genus to replace Gray's second *Isodictya*.

Here, then, arises a considerable uncertainty as to the correct nomenclature, not only of the genus, but also of the species known as *palmata*.

For the present we retain the name *Homœodictya* for the subgenus, and include therein only three species, viz., *Desmacidon* (*Homœodictya*) *palmata*, Johnst. (? = *Spongia digitata*, Esper), and the two new species *Desmacidon* (*Homœodictya*) *kerguelenensis*, nobis, and *Desmacidon* (*Homœodictya*) *grandis*, nobis, all characterised by the peculiar form of the isochelate microsclera.

The above does not pretend to be a complete history of the subgenus, which time and space do not permit, and it will be seen by reference to Johnston (*loc. cit.*) that there is still a considerable amount of literature to which we have not alluded. It appears to us that the characters separating the three species of *Homœodictya* from *Desmacidon* are only of subgeneric value, one very strong piece of evidence in favour of this view being the intermediate position of *Desmacidon conulosa*, nobis.

The peculiar backward process of the anterior palm of the chelate spicule is a

[1] *Ann. and Mag. Nat. Hist.*, ser. 5, vol. x. p. 110.

[2] Esper, Die Pflanzenthiere, Fortsetzungen, i. p. 190, pl. l.

character which would seem to be not confined to this subgenus, for Mr. Carter figures a similar structure in the isochelate spicules of his *Microciona affinis*;[1] further information concerning the latter species is, however, much needed, especially with regard to the megasclera.

The new Challenger species are very closely related to that of Johnston and Bowerbank, and it is exceedingly interesting to meet with such intimately related forms in such distant localities as Great Britain, Kerguelen, and the Cape of Good Hope.

Desmacidon (*Homœodictya*) *kerguelenensis*, Ridley and Dendy (Pl. XXIII. figs. 3, 3*a*, 3*b*, 3*c*; Pl. XXIV. fig. 3).

1886. *Homœodictya kerguelenensis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5. vol. xviii. p. 346.

Sponge (Pl. XXIV. fig. 3) lobate or digitate. The larger of the two specimens obtained consists of a short peduncle, narrower towards the base and then expanding and dividing into two divergent, stout, finger-like lobes of very unequal size. Height of the sponge 69 mm. Diameter of lobate processes 13 mm. *Colour* in spirit light brownish-yellow. *Texture* soft, spongy and resilient. *Surface* rough to the touch, woolly-looking and minutely hispid. *Dermal membrane* delicate, transparent. *Oscula* few, small and scattered. *Pores* irregularly scattered, abundant in parts, diameter about 0·1 mm.

Skeleton.—Very loose and ill-defined, consisting of an irregular, somewhat Isodictyal reticulation of oxeote spicules, occasionally forming fibres.

Spicules.—(*a*) *Megasclera;* of one kind only, viz., simple oxea (Pl. XXIII. figs, 3, 3*a*) short and rather stout, tapering gradually to a sharp point at each end; size about 0·35 by 0·019 mm. (*b*) *Microsclera;* the peculiar palmate isochelæ of the genus (*vide supra;* and Pl. XXIII. figs. 3*b*, 3*c*); length about 0·028 mm.

We were at first inclined to regard this sponge as a variety of the British species, *Desmacidon* (*Homœodictya*) *palmata*, which it very nearly approaches both in external form and in spiculation. There can be no doubt that the two are closely related, but on the whole it appears better to separate the Kerguelen form as distinct. The main differences between the two concern (1) the size of the oxeote spicules, which in *Desmacidon* (*Homœodictya*) *palmata* (according to Bowerbank's preparations in the British Museum) are little more than half as long as in the Kerguelen form; (2) the skeleton fibre, which is more distinct and highly developed in Bowerbank's than in the Challenger specimens. The isochelæ are of about the same size in the two species, and present no important structural differences. The ends of the anterior palms are, as a rule, more turned out in the British species, and the angle which they make with

[1] *Ann. and Mag. Nat. Hist.*, ser. 5, vol. vi. p. 41, pl. iv. fig. 15.

the backwardly projecting process is greater than in the Kerguelen form. Mr. H. J. Carter[1] has given a very good description of this spicule in *Desmacidon* (*Homœodictya*) *palmata*, with two excellent figures, the correctness of which was most satisfactorily verified by reference to the Bowerbank collection in the British Museum; it appears to us, however, that the lateral fimbriæ of the shaft are usually broader than he has represented them, and the spicule thus makes a still closer approach to that of *Desmacidon* (*Homœodictya*) *kerguelenensis* than might be judged from his figure.

Locality.—Royal Sound, Kerguelen, 25 fathoms. Two specimens.

Desmacidon (*Homœodictya*) *grandis*, Ridley and Dendy (Pl. XXII.; Pl. XXIX. figs. 7, 7*a*).

1886. *Homœodictya grandis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 347.

Sponge (Pl. XXII. fig. 1) compressed, lamelliform; presumably of erect growth. The single specimen in the collection consists of a large, very broad, very much flattened lamella, at one end proliferating into compressed, digitate branches, at the other consisting of a simple, flat expansion with incipiently lobate margin. One side of the frond bears very numerous, stellately arranged oscula, placed at very regular intervals from one another; these form a very prominent feature of the sponge; they are entirely absent from the other side (*cf.* Pl. XXII. figs. 1*a*, 1*b*). The specimen is of rather irregular shape and has been broken off along its lower margin, so that we cannot tell how far it extended in a vertical direction; in its present condition it is much broader than it is high, the greatest breadth being about 275 mm. (the lower margin, however, is only about 162 mm. long) and the greatest height about 150 mm. The thickness at the broader end of the piece is about 6 mm. and at the narrower end about 2·5 mm. *Colour* in spirit greyish-yellow. *Texture* firm, tough, fibrous, resilient. *Surface* on both sides very fairly even, but minutely conulose and very minutely hispid; conuli most prominent towards and on the free margin; very harsh to the touch. *Dermal membrane* thin, transparent, delicate, stretched between the conuli. *Oscula* minute, arranged in stellate groups of about four each, on one side only of the frond (Pl. XXII. fig. 1*b*); each group about 2 mm. in diameter; these groups of oscula are very abundant and arranged at fairly constant intervals of about 6 mm. from one another. *Pores* not found.

Skeleton.—Very well developed; composed of stout, branching, *Axinella*-like spiculofibre, made up of stout oxeote spicules. These spicules have each one end imbedded in the fibre, while the other projects outwards, towards the surface of the sponge, at a slight angle. The fibres trend towards the surface, where they terminate in tufts of oxeote spicules, thus giving rise to the surface conuli. Parallel fibres may in places be connected by loose crossing spicules.

[1] *Ann. and Mag. Nat. Hist.*, ser. 5, vol. x. p. 111, fig. 1, *a* and *b*.

Spicules.—(*a*) *Megasclera;* stout, smooth, fusiform oxea (Pl. XXIX. fig. 7), bent at more or less of an angle in the middle, sharply and gradually pointed, size about 0·45 by 0·04 mm. (a few small, slender styli were also observed, but as these are almost certainly foreign we shall say nothing further about them). (*b*) *Microsclera;* of one kind only; viz., very abundant isochelæ (Pl. XXIX. fig. 7*a*), with well-developed front palms, giving off each a distinct, stout, backward process. The lateral palms are united with the shaft up to their ends (*i.e.*, up to a level with the end of the front palm), but the middle portion of the shaft is not fimbriated as in *Desmacidon* (*Homœodictya*) *kerguelenensis*; they are large, handsome spicules about 0·063 mm. long; not infrequently there is an irregular swelling in the central portion of the shaft.

This species differs from *Desmacidon* (*Homœodictya*) *kerguelenensis*, nobis, in the arrangement of the skeleton, in the larger size of both megasclera (which are here much stouter) and microsclera, in the non-fibriation of the shaft of the latter, and very markedly in external form. In the arrangement of the skeleton it agrees exactly with *Desmacidon conulosa*, nobis (*vide* p. 106), and this gives to the two a very similar look; the two species differ, however, externally, in the arrangement of the oscula and, microscopically, in the form of the isochelate spicules; yet we think the two come very near together, and in general appearance they are much more like one another than are *Desmacidon* (*Homœodictya*) *grandis* and *Desmacidon* (*Homœodictya*) *kerguelenensis* (*cf.* Pl. XXII. fig. 1, with Pl. XXIV. figs. 2 and 3).

Locality.—Simon's Bay, Cape of Good Hope, November, 1873; 10 to 20 fathoms. One specimen.

Genus *Artemisina*, Vosmaer.

? 1885. *Artemisina*, Vosmaer, Sponges of the "Willem Barents" Expedition, 1880 and 1881, p. 25.

Body compact, texture like that of Suberitidæ. Megasclera monactinal; styli or subtylostyli. Microsclera isochelæ and spined toxa.

Vosmaer's original diagnosis runs as follows:—"Body covered with a thin dermis forming here and there thin oscular tubes. Sponge-mass rather compact, about as Suberites. Generic spicules tr. ac | ∧ sp. | anc^2. | "

The only species which we include in the genus is the original type, *Artemisina suberitoides.*

Artemisina suberitoides, Vosmaer.

? 1885. *Artemisina suberitoides*, Vosmaer, Sponges of the "Willem Barents" Expedition, 1880 and 1881, p. 25, pl. i. fig. 16; pl. iv. figs. 11–14; pl. v. figs. 51–55.

As the species has already been fairly fully described and figured, we can dismiss it very briefly. It is extremely unfortunate that Dr. Vosmaer gives no spicular measure-

ments; without knowledge of this important character identifications are usually a very difficult matter; the figures and description of the external form and spiculation of this sponge are, however, sufficient to convince us that we have really got hold of the same thing, and this conviction is strengthened by the fact that both specimens come from high northern latitudes.

The spiculation (taken from the Challenger specimen, for we have had no opportunity of examining the original type) is as follows:—(*a*) *Megasclera;* of one kind only, viz., smooth, slender, straight subtylostyli, with slightly developed oval heads, and tapering gradually to a fine point at the apex; size about 0·6 by 0·0075 mm. (*b*) *Microsclera;* of two kinds; (1) minute isochelæ, very abundant, about 0·0126 mm. long; (2) slender toxa, with spined ends, size very variable, apparently reaching as much as about 0·4 mm. in length (as shown by a single broken spicule, of which one limb was measured and doubled to give the total length), commonly much smaller, about 0·15 mm. long.

Locality.—Station 49, May 20, 1873; lat. 43° 3′ N., long. 63° 39′ W.; south of Halifax, Nova Scotia; depth, 85 fathoms; bottom, gravel, stones; bottom temperature, 35°·0. One specimen, attached to a stone.

Habitat.—Arctic Seas (Vosmaer); south of Nova Scotia (Challenger).

Genus *Phelloderma*,[1] Ridley and Dendy (Pl. XXIII.).

1886. *Phelloderma*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 347.

Corticate, with a cork-like ectosome. Megasclera all monactinal, styli or tylostyli, radiating towards the surface, with the points directed outwards; microsclera isochelæ.

In the presence of a distinct cortex, and in the radiate arrangement of its skeleton, this genus approaches the Suberitidæ, but its stylote megasclera and isochelate microsclera leave no doubt that its real place is amongst the Desmacidonidæ. Although there is only a single specimen, yet its characters are so well marked that they appear to us to justify the erection of a new genus for its reception.

Phelloderma radiatum, Ridley and Dendy (Pl. XXIII. figs. 8, 8*a*, 8*b*, 8*c*, 8*d*).

1886. *Phelloderma radiatum*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 347.

Sponge subglobular, with a concave base of attachment (originally based upon a *Sporadopora*, from which it has been removed), about 13 mm. in diameter, with a

[1] From Greek φελλός, cork; and δέρμα, skin.

distinct, cork-like cortex lying immediately below the dermal membrane, about 0·24 mm. thick. *Colour* in spirit light brown. *Texture* corky, internally fibrous. *Surface* fairly smooth. *Dermal membrane* fairly distinct and peeling off readily in strips. *Oscula* apparently few, scattered, each on a small papilla, but the condition of the specimen is such as to make it difficult to be certain of this. *Pores* (?).

Skeleton.—Radiately arranged. From about the centre of the base bands of spiculo-fibre radiate to the surface, where they terminate in brushes of stylote spicules with their points directed outwards and embedded in the dense cortex.

Spicules.—(*a*) *Megasclera;* of one kind only, viz., straight, smooth styli (Pl. XXIII. figs. 8, 8*a*), verging upon tylostyli, fairly gradually and sharply pointed, often with the shaft slightly bulbously dilated at intervals; size about 0·65 by 0·0126 mm. (*b*) *Microsclera;* of one kind only, viz., isochelæ, of very peculiar form (Pl. XXIII. figs. 8*b*, 8*c*, 8*d*), with three distinct, rather palmate teeth at each end and with a diamond-shaped "tubercle" (Carter); often the two anterior teeth are seen to be connected together by their apices (Pl. XXIII. fig. 8*c*); length about 0·044 mm.

In addition to spicules the sponge contains a large amount of sand scattered irregularly through it. Unfortunately there is only a single small specimen and that not in very good condition.

Locality.—Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; off the mouth of the Rio de la Plata; depth, 600 fathoms; bottom, green sand. One specimen.

Genus *Sideroderma*,[1] Ridley and Dendy (Pls. VIII., IX.).

1886. *Sideroderma*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 348.

Sponge massive, with mammiform processes on the upper surface, provided with a more or less dense external rind, composed of tylote spicules horizontally arranged. Megasclera, tylota; microsclera, isochelæ of various forms, and, at any rate usually, sigmata and trichodragmata.

Only a single species of the genus, and of that only a single specimen, is present in the collection; but this differs so markedly from all other known Desmacidonidæ that it seems advisable to found a new genus for its reception, more especially as we have been enabled, through the kindness of Dr. R. v. Lendenfeld, to examine a second species which occurs in his large collection of Australian sponges. The description of this second species has not yet been published, but an examination of it has enabled us to give a much more satisfactory generic diagnosis than would otherwise have been the case.

[1] From Greek σίδηρος, iron and δέρμα, skin.

Histoderma appendiculatum, Carter,[1] appears to resemble this genus more strongly than any other described sponge, having a similar form (though the tubes on the surface are very long), a similarly arranged skeleton, and stout sigmata; but as the chela is of a normal form, and the sponge possesses no tylote spicules, the resemblance may have no classificatory importance.

Sideroderma navicelligerum, Ridley, sp. (Pl. VIII. fig. 9; Pl. IX. figs. 5, 8, 9).

1885. *Crella navicelligera*, Ridley, Narr. Chall. Exp., vol. i. pt. 2, p. 571.
1886. *Sideroderma navicelligerum*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 348.

Sponge (Pl. VIII. fig. 9) hemispherical, adhering by its broad surface; consisting of a very hard, dense, external rind (whence the generic name), about 1 mm. in thickness, and of an underlying soft mass of tissues containing numerous microsclera and loose megasclera but no fibre. From the surface of the sponge arise a great number of papillæ, about 6 mm. in height, some with a (contracted) osculum at the extremity. Size of the specimen 44 mm. in diameter at the base by 31 mm. thick. *Colour* in spirit pale, dirty yellow. *Texture*, externally very hard and dense; internally soft, pulpy, amorphous (possibly a good deal decomposed). *Surface* smooth, except for the numerous papillæ. *Oscula* on the summits of papillæ.

Skeleton.—No horny fibre is present. The main part of the skeleton lies in the external rind. This consists of a very dense, felted mass of tylote spicules arranged with some degree of order in two main directions parallel to the surface. The spicules lie in layers, touching one another, the spicules of the same layer lying more or less in the same direction and at right angles to the spicules of the layer above or below. In a vertical section through the rind (Pl. IX. fig. 9) we sometimes see very plainly the alternating layers of longitudinally placed spicules, and of transverse sections of the spicules. Occasionally spicules are found more or less vertical to the surface. The spicules of the external rind are all dumb-bell-shaped (tylota), and this adds very much to their efficiency, for by the interlocking of the heads of such spicules one with another a far firmer structure is produced than if the spicules were simply oxea or strongyla.

Spicules.—(*a*) *Megasclera*; tylota, each spicule consisting of a long, cylindrical shaft, with an oval head at each end (Pl. IX. fig. 5, *a*, *b*). Length 0·28 to 0·595 mm.; diameter of shaft in middle 0·0063 to 0·0126 mm. The shaft is thickest in the middle, and tapers slightly and gradually towards the knob at each end. These spicules also occur abundantly scattered about in the soft tissues beneath the rind, and it is from these that the measurements given above are taken. (*b*) *Microsclera*; these are exceedingly abundant in the deeper tissues (the isochelæ also occur in the rind); and vary

[1] *Ann. and Mag. Nat. Hist.*, ser. 4, vol. xiv. p. 220; pl. xiv. figs. 23–25; pl. xv. fig. 39.

considerably in shape and size; there are five kinds present; (1) trichodragmata (Pl. IX. fig. 5, *c*); bundles of very fine hairs, measuring (the bundles) about 0·455 by 0·175 mm.; these occur in great abundance; (2) large, stout sigmata (Pl. IX. fig. 5, *d*), some only very slightly contort, others considerably so; size 0·06 by 0·0047 mm.; (3) small, thin, contort sigmata[1] (Pl. IX. fig. 5, *e*), size 0·0189 by 0·0015 mm.; (4) a few tridentate isochelæ, about 0·019 mm. long; (5) minute isochelæ (Pl. IX. figs. 5, *f*, and 8), 0·01 mm. long, of very peculiar form. The shaft is much expanded laterally and, when viewed from the side, is seen to be notched in the centre. There is only one tooth at each end, which is sharply recurved; owing to the minute size it is difficult to make out further details.

Only one specimen of this species is present. It has evidently been cut from a stone or some other attachment, so that in place of the base of the sponge a large circular aperture is left; this leads into a large cavity, caused by the shrinking up, and perhaps partly by the loss of the internal soft tissues. Perhaps the most remarkable feature about the sponge is the exceedingly hard and tough external rind, formed as described above, a feature not at all common amongst the Desmacidonidæ. The great number and variety of microsclera is also noteworthy.

Locality.—Station 188, September 10, 1874; lat. 9° 59′ S., long. 139° 42′ E.; off the south-west corner of New Guinea; depth, 28 fathoms; bottom, green mud. One specimen.

Genus *Iophon*, Gray (Pls. XVI., XVII.).

1867. *Iophon*, Gray, Proc. Zool. Soc. Lond., May 1867, p. 534.
1867. *Alebion*, Gray, Proc. Zool. Soc. Lond., May 1867, p. 534.[2]

Sponge soft and crumbling, usually dark coloured. Skeleton divisible into (*a*) a dermal layer of diactinal spicules, usually tylota, *i.e.*, with knobbed extremities which may be smooth or spined, and (*b*) a deep-lying reticulation of loose spiculo-fibre, composed of stylote spicules which are generally more or less spined. (? The proper skeleton may be replaced by foreign bodies, such as sand-grains, foreign spicules, &c.) Microsclera generally of two kinds. (*a*) Palmate anisochelæ, the small end of which terminates in a sharp spur; these appear to be constant. (*b*) Bipocillate spicules, very characteristic of the genus and almost always present, consisting of a curved shaft terminated by a cup-shaped expansion at either end, which is sometimes divided into lobes in a trefoil-like manner.

Species of this genus may generally be recognised by the combination of several of the above characters. A good external guide is the dark colour, many species being black. The sponge is usually an amorphous mass of crumbling substance, but it may

[1] Possibly young forms of the larger ones.
[2] For further generic synonyms, see under *Iophon pattersoni*.

occasionally assume a definite shape, as in *Iophon piceum*, Vosmaer, which is cup-shaped, and in *Iophon cylindricus*, nobis, which is cylindrical. A common feature of the genus is the distinctness of the dermal membrane and pores.

Of the spicules the most remarkable are the bipocilli, which are, so far as we are aware, confined to the genus.

The genus has a wide distribution, as will be seen by reference to the localities given for the various species, of which six were obtained by the Challenger.

Iophon pattersoni, Bowerbank, sp.

1866. *Halichondria Pattersoni*, Bowerbank, Mon. Brit. Spong., vol. ii. p. 255; vol. iii. p. 115, pl. xlvi.
1866. *Halichondria scandens*, Bowerbank, Mon. Brit. Spong., vol. ii. p. 259; vol. iii. p. 112, pl. xlv.
1866. *Halichondria Hyndmani*, Bowerbank, Mon. Brit. Spong., vol. ii. p. 264; vol. iii. p. 115, pl. xlvi.
1866. *Halichondria nigricans*, Bowerbank, Mon. Brit. Spong., vol. ii. p. 266; vol. iii. p. 113, pl. xlv.
1867. *Alebion hyndmani*, Gray, Proc. Zool. Soc. Lond., May 1867, p. 534.
1867. *Iophon scandens*, Gray, Proc. Zool. Soc. Lond., May 1867, p. 534.
1867. *Iophon nigricans*, Gray, Proc. Zool. Soc. Lond., May 1867, p. 534.
1880. *Esperia Pattersoni*, Vosmaer, Notes from Leyden Museum, vol. ii. p 143.
1880. *Esperia Hyndmani*, Vosmaer, Notes from Leyden Museum, vol. ii. p. 144.
1880. *Esperia scandens*, Vosmaer, Notes from Leyden Museum, vol. ii. p. 144.
1880. *Esperia nigricans*, Vosmaer, Notes from Leyden Museum, vol. ii. p. 144.
1881. *Alebion proximum*, Ridley, Proc. Zool. Soc. Lond., January 1881, p. 117.

Sponge massive, amorphous, crumbling. Colour dark brown. Surface uneven, corrugated.

The skeleton consists of (1) a dermal layer of long, dumb-bell-shaped spicules (tylota) with the knobs usually slightly spined and the shaft smooth. (2) A rather loose reticulation of spined stylote spicules penetrating all through the body. Two kinds of microsclera are present; (1) palmate anisochelæ, with pointed smaller ends, very fine, measuring up to 0·03 mm. long. (2) Minute bipocilli. Both of these vary greatly in numbers in different specimens, and in different parts of the same specimen. For measurements of the styli and tylota see the table given below.

The Challenger specimens of *Iophon* from Stations 308, 311, and from Tristan da Cunha form connecting links between several previously known, though ill-defined, forms. We are thus enabled to unite these several forms as varieties of a single species. In all of them the external appearance seems to be the same, and the distinction has lain chiefly in slight variations in form and size of the spined styli and of the tylota (*vide* table below). The microsclera vary considerably in the numbers in which they occur, but this cannot be considered as a specific distinction. We thus have a single species

in place of five, for which we adopt the name *pattersoni*, that being the earliest we can find (*vide* synonymy above). The species has a wide range, and presents considerable variation in its spiculation. It is not improbable that other forms, hitherto regarded as distinct, will also sooner or later have to be included in this species. *Iophon piceum*, Vosmaer, comes near to it in spiculation, but is described as cup-shaped; it is unusual for an *Iophon* to have a well-marked external form, and this is perhaps a good specific character.

Variety.	Spined Styli.		Tylota.		Locality.
		mm.		mm.	
proximum	Slightly spined all over; tapering from near apex, . . .	0·158 by 0·009	With distinct heads, which are distinctly spined, . . .	0·16 by 0·008	Strait of Magellan.
(Challenger)	Slightly spined all over, more so near the base and apex; tapering from near apex, .	0·17 by 0·007	Heads very slightly developed, very feebly or not at all spined, .	0·19 by 0·005	Tristan da Cunha.
nigricans	Slightly spined, more so on the base, apex usually smooth; tapering gradually from base to apex, . .	0·213 by 0·008	Very slender; heads barely visible or absent, not spined, .	0·195 by 0·003	British Isles.
(Challenger)	Considerably spined all over; tapering from near apex, . .	0·22 by 0·01	Heads distinct and distinctly spined, .	0·2 by 0·006	Off south-west coast of Patagonia.
hyndmani	Spines mostly near base; tapering from middle,	0·228 by 0·019	Very slight, faintly spined heads, . .	0·196 by 0·004	British Isles.
pattersoni	Slightly spined all over; tapering from near middle, . . .	0·234 by 0·01	Heads scarcely distinguishable from shaft,	0·25 by 0·006	British Isles.
(Challenger)	Strongly spined all over; tapering from near apex, . . .	0·24 by 0·011	Heads distinct, slightly spined, . . .	0·24 by 0·007	Off west coast of Patagonia.
scandens	Very slightly spined all over; tapering from near apex, . .	0·262 by 0·012	Heads distinct, slightly spined, ...	0·245 by 0·006	British Isles.

Localities.—Station 308, January 5, 1876; lat. 50° 8′ 30′ S., long. 74° 41′ 0″ W.; off the west coast of Patagonia; depth, 175 fathoms; bottom, blue mud. Fragments.

Station 311, January 11, 1876; lat. 52° 45′ 30″ S., long. 73° 46′ 0″ W.; off the south-west coast of Patagonia; depth, 245 fathoms; bottom, blue mud; bottom temperature, 46°. A number of fragments.

Off Nightingale Island, Tristan da Cunha. A number of fragments.

Habitat.—The Minch (Bowerbank); Strangford Loch (Professor Dickie, given by Bowerbank); off Hastings (Bowerbank); Shetland (Norman, given by Bowerbank); Strait of Magellan (Ridley); Tristan da Cunha (Challenger); west coast of Patagonia (Challenger).

Iophon chelifer, Ridley and Dendy (Pl. XVI. fig. 3 ; Pl. XVII. figs. 1, 3, 8).

1886. *Iophon chelifer*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 349.

Sponge (Pl. XVI. fig. 3) amorphous,[1] massive, honeycombed. *Colour* in spirit light brown to black. *Texture* soft, crumbling. *Surface* smooth.

Skeleton.—Composed of an irregular, loose reticulation of spined stylote spicules ; the meshes of the network are more or less rectangular, so that there are two main lines of spicules distinguishable, though only roughly, one of which is approximately perpendicular to the surface.

Spicules.—(*a*) *Megasclera;* (1) spined styli (Pl. XVII. fig. 1, *a*, *b*), measuring 0·36 to 0·42 by 0·016 to 0·02 mm.; (2) there are also present a few tylote spicules (Pl. XVII. fig. 1, *c*), apparently confined to the surface, size 0·25 to 0·32 by 0·01 mm.; these spicules have the shaft smooth and the knobbed extremities minutely spined. (*b*) *Microsclera ;* very abundant, of two kinds ; (1) anisochelæ (Pl. XVII. fig. 8), from 0·019 to 0·03 mm. long ; (2) bipocilli (Pl. XVII. fig. 3), large (0·019 mm. long) and of very peculiar form ; shaft narrow and strongly bent, small end clawed, with two prongs (whence the specific name), large end bearing two, three, or (very rarely) four expanded flukes, which together form a hollow cup. These spicules occur lining the canals ; the large end is embedded in the wall of the canal, and the small, clawed end projects freely into its lumen.[2] They also occur scattered abundantly through the soft tissues (perhaps owing to displacement ?). This spicule is the most interesting feature about the species ; it throws considerable light on the relations of the more minute bipocillate spicules of other sponges. We are inclined to regard it as a much modified anisochela; its variability in form (*i.e.*, in the number of flukes forming the larger end of the spicule) is also noteworthy.

Three specimens of this interesting species are present, two are fairly large, but broken into fragments, the other is small, and occurs encrusting a branched Polyzoon. The latter is in all probability a young form, and differs in several minor respects from the larger specimens ; in it the anisochelæ are mainly arranged in rosettes, with the small ends in the centre, they are very abundant, while, on the other hand, the bipocillate spicules are very few and apparently imperfectly developed. The species differs very decidedly from all described forms in the large size and also in the degree of

[1] Exact form uncertain, specimen fragmentary.

[2] This arrangement would seem to be connected with the protection of the walls of the canals, probably from animal intruders, rendering the spicules truly defensive, a term which cannot be applied to all the spicules thus named by Bowerbank. The cases in which a spicule may reasonably be assumed to fulfil this purpose are very few, that of the diancistra or "trenchant bihamates" (see Bk., Mon. Brit. Spong., vol. i. p. 34) being perhaps the best established case hitherto recorded. *Cf.* also the sigmata in *Esperella murrayi*, nobis.

elaboration of the bipocillate spicules. The other spicules are also larger in almost every case than the corresponding forms in other species of *Iophon*; *Iophon* (*Alebion*) *piceum*, Vosmaer, approaches it the most nearly in this respect, but even in this species the stylus measures only 0·32 mm. in length.

Localities.—Station 142, December 18, 1873; lat. 35° 4′ S., long. 18° 37′ E.; off the Cape of Good Hope; depth, 150 fathoms; bottom, green sand; bottom temperature, 47°. The young specimen.

Station 145A, December 27, 1873; lat. 46° 41′ S., long. 38° 10′ E.; off Prince Edward Island; depth, 310 fathoms; bottom, volcanic sand.

Station 148A, January 3, 1874; lat. 46° 53′ S., long. 51° 52′ E.; between Prince Edward and Kerguelen Islands; depth, 550 fathoms; bottom, hard ground, gravel, shells.

Iophon cylindricus, Ridley and Dendy (Pl. XVI. fig. 4; Pl. XVII. fig. 6).

1886. *Iophon cylindricus*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 349.

Sponge (Pl. XVI. fig. 4) erect, cylindrical (whence the specific name), with expanded base encrusting a dead Pecten shell; showing a slight tendency to branch at the apex. Height, including base, 44 mm. Average diameter 6 mm. (A second specimen, also growing on a dead shell, appears to represent little more than the base of the sponge.) *Colour* in spirit brown. *Texture* brittle and crumbling. *Dermal membrane* very distinct, transparent, and with numerous round pores. *Oscula* scattered over the surface (?).

Skeleton.—(*a*) *Dermal;* a very well developed network of not very closely aggregated tylota. (*b*) *Main;* a reticulation of loose spiculo-fibre, composed of stylote spicules.

Spicules.—(*a*) *Megasclera;* slightly curved, smooth styli (Pl. XVII. fig. 6, *a*, *b*), each tapering from near the apex to a very sharp point; size 0·25 to 0·29 by 0·011 mm. (*b*) *Microsclera;* of two kinds; (1) palmate anisochelæ of the usual *Iophon* type, measuring 0·025 mm. in length; (2) bipocilli, numerous and of the usual shape, 0·0127 mm. long.

It will be seen that this species approaches *Iophon laminalis*, nobis, in the smoothness of the styli, but the external form is very different. Further, the tylota are little more than half as stout, and the styli only half as stout and not half as long as the corresponding spicules in that species.

Locality.—Station 163A, April 4, 1874; lat. 36° 59′ S., long. 150° 20′ E.; north-east of Cape Howe, Australia; depth, 120 fathoms; bottom, green mud. Two specimens.

Iophon laminalis, Ridley and Dendy (Pl. XVI. fig. 6; Pl. XVII. figs. 9, 11).

1886. *Iophon laminalis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 349.

Shape doubtful. In its present condition the specimen consists of a number of irregular, flat, or slightly curved, cake-like expansions (Pl. XVI. fig. 6), which, taken together, cover an area of about 250 square centimetres. These have no appearance of having lain on the bottom of the sea, and as they seem too thin and fragile to have stood erect as a flat lamina, we are inclined to think that, when living, the sponge had a cup-like form, like *Alebion* (*Iophon*) *piceum*, Vosmaer,[1] from Barents Sea. Thickness of the lamellæ 4 to 17 mm. The two sides are slightly different in appearance, one being smoother than the other. There is a distinct, thin, *dermal membrane*, especially visible on the smooth side. *Colour* in spirit dark reddish-brown. *Surface* uneven, with numerous small *oscula* scattered over it on both sides of the lamellæ. *Texture* loose, crumbling, slightly stringy.

Skeleton.—(*a*) *Dermal;* a network (not always easy to make out) of tylota. (*b*) *Main;* a loose reticulation, not arranged in definite meshes, of large, subtylostylote spicules arranged longitudinally along certain tracts, so as to form long but loose fibres, which give rise to the somewhat stringy character of the sponge.

Spicules.—(*a*) *Megasclera;* (1) large subtylostyli (Pl. XVII. fig. 11, *b*), measuring 0·63 by 0·022 mm. The heads of these spicules are only faintly developed, so that they are very nearly simply stylote, and they taper somewhat suddenly, from near the apex, to a sharp point. (2) Tylota (Pl. XVII. fig. 11, *a*), shaft and head usually smooth, but head sometimes minutely spined; size 0·34 by 0·0013 mm. (*b*) *Microsclera;* two kinds are present as usual. (1) Palmate anisochelæ, 0·025 mm. long; (2) bipocilli (Pl. XVII. fig. 9) 0·013 mm. long The palmate anisochelæ seem to be very rare in the one specimen present; but the bipocilli are extremely abundant and very fine, consisting each of a curved shaft with a large cup-shaped expansion at one end and a small one at the other.

Only one specimen, broken into fragments, of this interesting species was obtained. In the fine state of development of its bipocillate microsclera it approaches *Iophon chelifer*, a specimen of which was obtained at the same station; while in external form it probably comes near to *Iophon piceum*, Vosmaer.[2] The species to which it is perhaps most nearly related is, however, *Iophon cylindricus*, which, like it, has the stylote spicule smooth; but, as will be seen from the description of that species, the proportions of the spicules in the two differ very widely; and, as in probably no other known *Iophon*, the styli here show a tendency to become tylostylote.

Locality.—Station 145A, December 27, 1873; lat. 46° 41′ S., long. 38° 10′ E.; off Prince Edward Island; depth, 310 fathoms; bottom, volcanic sand. One specimen.

[1] *Niederländ. Archiv f. Zool.*, Suppl. Bd. i., 1881–2, p. 42, pl. i. fig. 19, pl. iii. figs. 75–82.

[2] *Loc. cit., supra*, pl. i. fig. 19.

Iophon abnormalis, Ridley and Dendy (Pl. XVII. figs. 5, 7).

1886. *Iophon abnormalis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 350.

Sponge represented in the collection by two small, cylindrical fragments, the larger of which is branched, and measures 19 mm. in length by 4 mm. in average diameter. *Colour* in spirit black. *Texture* brittle and crumbling. *Dermal membrane* distinct, transparent, perforated by very distinct, round or oval pores.

Skeleton.—(*a*) *Dermal;* a network of tylota, loosely placed. (*b*) *Main;* a loose reticulation of stylote spicules.

Spicules.—(*a*) *Megasclera;* (1) styli (Pl. XVII. fig. 5, *c*), generally spined at the base and also slightly at the apex; size about 0·35 by 0·0126 mm. (2) Tylota (Pl. XVII. fig. 5, *a*, *b*), each with a nearly straight or slightly curved shaft, bearing a distinct spined knob at each end; size about 0·28 by 0·008 mm. (*b*) *Microsclera;* only the anisochelæ appear to be present, but these are of two very distinct sizes. (1) Large palmate anisochelæ of the usual *Iophon* type, 0·0378 mm. long, arranged mainly in very fine rosettes (Pl. XVII. fig. 7). (2) Smaller anisochelæ of about half the size. It is of course possible that the smaller anisochelæ are merely young forms of the larger ones, but it is noteworthy that it is the larger ones, and not the smaller, which are arranged in rosettes.

It is very abnormal to find an *Iophon* without bipocillate spicules (hence the specific name), and in only one other specimen of *Iophon* have we seen the anisochelate spicules arranged in rosettes, viz., in a small specimen from Station 142, which we have referred (though the identification must be considered doubtful) to *Iophon chelifer*, considering it as a young form; in this also the bipocillate spicules were very rare.

Locality.—Off Marion Island, 50 to 75 fathoms. Two fragments.

Iophon (?) *omnivorus*, n. sp. (Pl. XVII. fig. 10).

Sponge massive, amorphous. Size of specimen 21 mm. long by 8 mm. broad. *Colour* in spirit light brown. *Texture* soft, brittle, very fragile (owing to its sandy skeleton). *Surface* smooth. *Dermal membrane* very distinct, transparent, perforated by numerous round or oval *pores*, about 0·035 mm. in diameter, aggregated in groups over subdermal cavities (Pl. XVII. fig. 10). *Oscula* doubtful (? on small, prominent papillæ).

Skeleton.—Composed chiefly of foreign bodies arranged so as to form a dermal layer (Pl. XVII. fig. 10) and a deeper skeleton, in the same way as the skeleton of other species of the genus *Iophon*. The nature of these foreign bodies is very various, sand grains, Foraminifera, Polyzoa, calcareous sponge spicules, foreign siliceous spicules, &c., occur in great profusion, and appear to take the place of the proper megasclera. We have, however, in the dermal membrane a good many tylota, some of which may be proper to the sponge; the heads and shafts of these are quite smooth and they vary much in size, probably many of them are foreign.

Spicules.—(*a*) *Megasclera;* doubtful. (*b*) *Microsclera;* two kinds are present. (1) Very numerous palmate anisochelæ of the characteristic *Iophon* type, 0·0145 mm. long; these spicules are frequently arranged around the walls of the canals, with the small end sticking into the wall and the larger end projecting into the cavity. They also occur very abundantly in the dermal layer. (2) A very few small bipocilli (? foreign).

It is, of course, very difficult, amongst such a number of foreign spicules of almost all sorts and sizes, to pick out just the ones which are proper to the sponge itself; hence it is with some hesitation that we refer this species to the genus *Iophon.*

The most abundant spicules, and those which are most certainly proper to the sponge, are the anisochelæ. The sand grains occur chiefly in the deeper parts of the sponge. They appear to be arranged, together with the other foreign bodies, without any definite order, and to take the place of the proper megasclera. The figure (Pl. XVII. fig. 10) will give some idea of the arrangement of the foreign bodies—chiefly sponge spicules—in the dermal layer.

In its collecting habit this sponge agrees closely with Marshall's *Phoriospongia,*[1] and it seems to us very probable that individual species out of several distinct genera have acquired the same habit of replacing their proper skeleton with a skeleton of foreign bodies. This is sufficient to distinguish the species unmistakably from all others as yet known of the genus *Iophon.*

Locality.—Station 163A, April 4, 1874; lat. 36° 59′ S., long. 150° 20′ E.; off the south-east coast of Australia; depth, 150 fathoms; bottom, green mud. One small specimen.

Genus *Amphilectus,* Vosmaer (Pls. XIX., XXV., XLVII.).

1880. *Amphilectus,* Vosmaer, Notes from the Leyden Museum, vol. ii. p. 109.

We make use of this genus in the manner indicated by its founder, namely, as a provisional receptacle for a number of doubtful Desmacidonidæ (Esperellinæ).

As regards the diagnosis and history of the genus we quote Vosmaer's later remarks on the subject.[2] "Stabnadeln glatt oder (und) gedornt. Dazu Anker oder (und) Schaufeln mit gleichen oder ungleichen Enden; eventuell auch Bogen und Haken. Sponginmasse sehr wechselnd. Kosmopolitisch;" this, of course, would include pretty well every species of Desmacidine, and Vosmaer continues:—"Es ist Amphilectus nur ein vorläufiges Aushilfe-Genus, wo alle diejenigen Desmacidinen untergebracht sind, von welchen keine besondere Merkmale bekannt sind, wodurch sie zu einer anderen Gattung kommen sollten." As such we accept it, but we have not made it quite so comprehensive as Vosmaer has done, and we include in it here only such Esperellinæ as possess isochelate microsclera and (usually) stylote megasclera, to which other forms of spicules

[1] *Zeitschr. f. wiss. Zool.*, Bd. xxxv. p. 122.

[2] Bronn's Klass. u. Ordn. des Thierreichs, Porifera, 1865, p. 353.

may be added; we are thus able to reduce its bulk very considerably, but even thus limited the genus is not a natural one.

Esperiopsis, Carter, as emended by us (above, p. 76) forms a natural genus which we have felt able to remove from the general mass of such sponges as Vosmaer unites under the name *Amphilectus*, and as our knowledge of the Desmacidonidæ increases it will no doubt become necessary similarly to detach other groups.

Amphilectus apollinis, Ridley and Dendy (Pl. XIX. figs. 3, 3*a*, 3*b*, 3*c*).

1886. *Amphilectus apollinis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 350.

Sponge massive, amorphous, cavernous. The largest specimen is oval, cake-shaped; about 50 mm. long by 38 mm. wide and 19 mm. thick. *Colour* in spirit light greyish-yellow. *Texture* rather soft and spongy. *Surface* very uneven, deeply folded, slightly glabrous in places where the dermal membrane remains uninjured. *Dermal membrane* fairly distinct. *Oscula* (?).[1]

Skeleton.—(*a*) *Dermal;* in some parts there is a very distinct, but confused, dermal reticulation of slender stylote spicules, while in other parts this appears to be scarcely represented. (*b*) *Main;* a confused Halichondrioid reticulation of stout, stylote spicules.

Spicules.—(*a*) *Megasclera;* of one kind only, but of two distinct sizes. (1) Stout, slightly curved, smooth styli (Pl. XIX. fig. 3), size about 0·5 by 0·0168 mm.; making up the main skeleton. (2) Slender, straight styli (Pl. XIX. fig. 3*a*), very sharply and gradually pointed, often very slightly spined at the base and with a slight tendency to become tylostylote; size about 0·315 by 0·0063 mm., almost entirely confined to the dermal layer. (*b*) *Microsclera;* of two kinds—(1) small palmate isochelæ (Pl. XIX. fig. 3*c*); length about 0·015 mm.; very abundant. (2) Large toxa (Pl. XIX. fig. 3*b*), of very beautiful form and with spined ends, size of the full-grown spicule about 0·3 by 0·0045 mm.; very abundant; the specific name has reference to them.

Vosmaer[2] has founded a genus *Artemisina* (*vide supra*) of which the most characteristic spicule is a toxite with spined ends[3] like that which occurs in *Amphilectus apollinis*. Possibly the two species *Artemisina suberitoides*, Vosmaer, and *Amphilectus apollinis*, nobis, come near to one another and may even belong to the same genus, but they differ very widely in the texture of the sponge, and our present species possesses an additional form of megasclera (viz., the slender stylus with spined base) not present in *Artemisina*.

The presence of spined toxa, taken alone, is certainly not a character of generic importance, for such spicules occur in several species that are widely distinct from one

[1] Both specimens are infested by very numerous small *Amphipoda* which live just below the surface, often causing it to be deeply pitted, but these pits must not be mistaken for oscula.

[2] Sponges of the "Willem Barents" Expedition, 1881–82, p. 25.

[3] *Loc. cit.*, pl. v. fig. 51.

another (*e.g.*, *Clathria lobata*, Vosmaer, *Suberites arciger*, Schmidt, *Artemisina suberitoides*, Vosmaer, *Amphilectus apollinis*, nobis).

Locality.—Royal Sound, Kerguelen; depth, 20 to 60 fathoms. Two specimens.

Amphilectus ceratosus, Ridley and Dendy (Pl. XIX. figs. 10, 10*a*; Pl. XXV. fig. 2; Pl. XLVII. fig. 2).

1886. *Amphilectus ceratosus*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 350.

Sponge (Pl. XXV. fig. 2) massive, lobate, sessile, of very irregular shape. The largest specimen is 44 mm. long and varies much in diameter. *Colour* in spirit dark reddish-brown. *Texture* spongy, elastic, but fairly compact. *Surface* uneven, with small, angular conuli, but glabrous. *Dermal membrane* rather thick, granular and of a brown colour, peeling off fairly easily. *Oscula* small and scattered, not noticeably elevated above the general surface of the sponge.

Skeleton (Pl. XLVII. fig. 2).—(1) Horny, consisting of a well-developed reticulation of ramifying and anastomosing horny fibre, without any spicular core. This horny fibre is doubtless the most important part of the skeleton functionally; it averages about 0·07 mm. in thickness. (2) Spicular—(*a*) *Dermal;* consisting of numerous, irregularly scattered tylote spicules. (*b*) *Main;* consisting of similar, irregularly scattered tylote spicules; there is no spiculo-fibre in the deeper parts of the sponge though the scattered spicules are everywhere abundant, but towards the surface the spicules are often collected into loose wisps.

Spicules.—(*a*) *Megasclera;* of one kind only; viz., straight, entirely smooth tylota (Pl. XIX. fig. 10), with a distinct oval head at each end of the slender shaft; size about 0·24 by 0·003 mm. (*b*) *Microsclera;* of one kind only; viz., isochelæ (Pl. XIX. fig. 10*a*), profusely scattered both in the dermal membrane and in the deeper parts of the sponge; length about 0·025 mm.

This sponge is extremely interesting on account of the existence in it of a well-developed horny skeleton. We at first thought that this might be due to the presence of a *Euspongia* over which the *Amphilectus* had grown, but there are in the collection three specimens, and there is not the slightest reason to suppose that the horny fibre is not proper to the species. The absence of a spicular core to the fibre must be especially noticed. Coincidently with the development of a horny skeleton we have great reduction in the spicular skeleton, and it is possible that we have in this species an actual transitional form between the Siliceous and Keratose sponges. The isochelate spicules, however, are very abundant throughout the sponge, and appear to have suffered no diminution in numbers. It is provisionally only that we include this sponge in the genus *Amphilectus*,

for want of a better one in which to put it; it is not unlikely that it may form the type of a new genus.

Mr. Carter[1] has described a sponge which appears to be related to our *Amphilectus ceratosus*. His *Suberites fistulatus* (the claims of which to the generic name *Suberites* are of the very faintest description, being, according to the author, "its cavernous and cork-like consistence") possesses tylote megasclera with microspined ends, and palmate, isochelate microsclera; as regards the presence or absence of horny fibre and the arrangement of the skeleton nothing is said. This sponge is also said to possess "long tubular extensions of different sizes," which "are prolonged from large vents." There can be little doubt that the species are distinct, despite the very similar spiculation.

Locality.—Off Port Jackson; depth, 7 fathoms. Three specimens.

Amphilectus pilosus, Ridley and Dendy (Pl. XIX. figs. 5, 5′, 5*a*, &c.; Pl. XXV. fig. 3).

1886. *Amphilectus pilosus*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 350.

There are in the collection two specimens which we unite under the above name. As the smaller is a poor, dried-up specimen our description will be taken from the larger, which is in good condition.

Sponge (Pl. XXV. fig. 3) lobate, consisting of a short, stout peduncle, about 13 mm. in diameter, expanding above into a single broad, thick lobe about 63 mm. broad and 19 mm. thick; total height of sponge, 81 mm. *Colour* in spirit dark chocolate-brown.[2] *Texture* very coarse and hairy, but rather compact. *Surface* pilose and shaggy, beset with tufts of large, projecting spicules; furrowed by deep longitudinal grooves which are not hairy like the rest of the surface. *Dermal membrane* distinct only in the grooves; deeply pigmented like all the rest of the sponge. *Oscula* small, scattered, partly in the grooves.

Skeleton.—In the dermal membrane, where this can be distinguished, are found a few irregularly strewn tylota, together with a few large styli, and very long, thin oxea. The main skeleton is irregular in the extreme; coarse, loose and very ill-defined bands of spiculo-fibre run towards the surface, where they terminate in the shaggy tufts of spicules; these represent the primary lines and they are crossed in all directions by loosely scattered spicules. There is very little horny uniting substance. In the peduncle the skeleton becomes much more dense, but is still very indefinite.

Spicules.—(*a*) *Megasclera;* (1) Tylota, with long, straight, slender shaft and fairly well developed heads, usually flattened and slightly and minutely spined at the ends; size

[1] *Ann. and Mag. Nat. Hist.*, ser. 5, vol. ix. p. 53.

[2] Possibly stained by other specimens in the same bottle.

about 0·42 by 0·0063 mm., dermal; (2) smooth styli (Pl. XIX. figs. 5, 5′), varying much in size, up to about 2·0 by 0·025 mm.; slightly curved and sharply and gradually pointed at the apex. Although styli of this size are abundant it is more common to find them much shorter and stouter, measuring about 0·77 by 0·034 mm. The styli make up the main skeleton. Besides these two forms there is a third large spicule which may be mentioned here, although it is probable that from its peculiar form it should be placed rather in the category of microsclera than that of megasclera (*vide infra*), only its great size argues against this view. It is a very long and very slender oxeote spicule (Pl. XIX. fig. 5*a*′′′′), sharply pointed at each end, and commonly with a single rather sharp bend in the centre; size up to about 2·0 by 0·01 mm. These spicules are abundantly scattered throughout the sponge and sometimes occur in bundles; their occurrence in the dermal membrane has already been referred to. (*b*) *Microsclera;* (1) very minute, palmate isochelæ, about 0·0065 mm. long, scarce; (2) large, stout toxa (Pl. XIX. figs. 5*a*, 5*b*, &c.), measuring about 0·35 by 0·0063 mm. This is about the average size, but there is very considerable variation in this respect, and indeed it is not difficult to pick out a connecting series between these toxa and the long oxea above mentioned. Such a series is represented on Pl. XIX. figs. 5*a*–5*a*′′′′.

This species is very well marked, and may be readily recognised both by its external appearance and its spiculation. All the spicules, except the minute isochela, which is unusually small, are of exceptionally large size. The toxa are probably the largest known examples of their kind. Some of them were found still enveloped by the mother-cell, as shown on Pl. XIX. fig. 5*b*. The most interesting feature of the species is, however, the manner in which the toxa appear to develop into oxea.

Localities.—Christmas Harbour, Kerguelen, 70 fathoms. One specimen (the type, from which our description is taken).

Off Marion Island, between 50 and 75 fathoms. One specimen.

Amphilectus annectens, Ridley and Dendy (Pl. XIX. figs. 4, 4*a*).

1886. *Amphilectus annectens*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 351.

Sponge massive, lobate, represented only by a single fragment, 25 mm. long by about 13 mm. broad. *Colour* in spirit pale, greyish-yellow. *Texture* very soft and spongy. *Surface* uneven, rugose, hispid in places (perhaps owing to artificial causes). *Dermal membrane* distinct, thin and transparent. *Oscula* small and scattered.

Skeleton.—(*a*) *Dermal;* consisting of tylota loosely scattered through the dermal membrane and also arranged in tufts beneath it. (*b*) *Main;* a very loose and irregular reticulation of large styli, in which no distinct fibre is discernible.

Spicules.—(*a*) *Megasclera;* of two kinds—(1) very large, stout, smooth, usually slightly

curved styli (Pl. XIX. fig. 4), tapering very gradually to a sharp point at the apex and evenly rounded at the base, size about 1·0 by 0·037 mm.; making up the main skeleton. (2) Tylota (Pl. XIX. fig. 4*a*), with smooth, straight shafts and oval heads, which are usually more strongly developed at one end of the shaft than at the other; indeed they may be almost absent at one end; the ends of these spicules are very slightly spined and sometimes flattened[1]; size about 0·525 by 0·01 mm.; dermal. (*b*) *Microsclera;* small, palmate isochelæ, thickly strewn through the dermal membrane and also abundant in the tissues below; length about 0·02 mm. We have also observed a few large, slender toxa with very faintly spined ends, length up to about 0·2 mm., and a few, usually contort sigmata, length about 0·063 mm.

This is an interesting species, and it is a pity that there are not more and better specimens of it. It unites the characters of most species of *Amphilectus*, viz., the possession of smooth stylote megasclera and of small palmate isochelæ, with a feature which is very characteristic of the genus *Myxilla*, viz., the possession of a tylote dermal spicule. Possibly the new species may form an important connecting link in this very perplexing series of sponges.

Locality.—Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; off the mouth of the Rio de la Plata; depth, 600 fathoms; bottom, green sand; bottom temperature, 37°·2.

Subfamily 2. Ectyoninæ.

1875. *Ectyonida*, Carter, Ann. and Mag. Nat. Hist., ser. 4, vol. xvi., p. 133.
1886. *Ectyoninæ*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 470.

Skeleton fibre echinated by laterally projecting spicules.

Genus *Myxilla*, Schmidt (Pls. XXVI., XXVII., XXX., XLVII.).

1862. *Myxilla*, Schmidt, Spong. Adriat. Meer., p. 71.
1880. *Hastatus, p. p.*, Vosmaer, Notes Leyden Mus., vol. ii. p. 136.

Megasclera of at least two kinds:—(1) monactinal:—styli, usually spined, main skeleton spicules; (2) diactinal:—variously ended; strongyla, oxystrongyla or tylota, chiefly dermal; to these are sometimes added (3) small spined styli, which echinate the main skeleton. Usually there is only a very small amount of spongin present. Microsclera tridentate isochelæ, to which sigmata are often added.

The genus *Myxilla* was founded by Schmidt in 1862 (*loc. cit.*), and the first species which he places therein is *Myxilla rosacea*, Liebkhn. sp. The original diagnosis runs as follows:—"Halichondriæ polymorphæ, molles et mucosæ, fragiles, fere omnes spiculis nodosis insignes," to which the author adds, "Ich gebe gern zu, dass diese Gattung auf

[1] It is doubtful whether flattening ever takes place at the larger end of the spicule.

schwachen Füssen steht." Vosmaer, in 1885,[1] gave a better diagnosis:—"Stabnadeln glatt oder gedornt; letztere vorwiegend. Spongin nicht oder kaum vorhanden. Anker drei-, selten zweizähnig, beide Enden gleich. Oberfläche am lebenden Objekt schlüpfrig. Canalsystem nach dem dritten Typus." This, however, is still very wide and might be made to include a great variety of forms. The Challenger material has enabled us to give a more definite diagnosis, taking as our starting point the original species, *Myxilla rosacea*, Lbkhn.

Still it may be questioned whether we have not made the genus too comprehensive, in that we have admitted certain species possessed of echinating spicules.[2] Vosmaer[3] has already done this in admitting Bowerbank's *Hymeniacidon paupertas* into the genus, but without pointing out the great importance of the step which he has taken. If we once admit forms with a distinct, special, echinating spicule, like that of *Myxilla paupertas*, into the genus *Myxilla*, then we do away with all family distinction between the Desmacidonidæ and Ectyonida. This step appears to us to be very desirable, as the distinction is a very unimportant one, and in the present work we have considered the Ectyoninæ (old Ectyonida) as a subfamily of the Desmacidonidæ.

The genus *Myxilla* as now constituted falls into two fairly natural groups; (1) species without definite echinating spicules, such as *Myxilla rosacea*, Lbkhn., and *Myxilla digitata*, nobis; (2) species with definite echinating spicules, such as *Myxilla paupertas*, Bk., and *Myxilla compressa*, nobis. The detailed comparison of two such forms as *Myxilla rosacea*, var. *japonica*, and *Myxilla compressa* furnishes a sufficient justification for uniting both groups under the same generic name, at any rate for the present. It will thus be readily seen that the genus really occupies an intermediate position between the subfamilies Esperinæ and Ectyoninæ.

The genus *Hastatus* of Vosmaer comprises simply *Myxillæ* of thoroughly normal type, the point on which its author lays especial stress, viz., the hastate ends of the dermal spicules, being well shown in the type species of *Myxilla* (*Myxilla rosacea*); and the type species of *Hastatus* (*Hastatus luridus*) belongs to the same section of the genus as *Myxilla rosacea* by virtue of its spined megasclera and the absence of echinating spicules. The other species (*Hastatus dickiei*) assigned to the genus apparently agrees with *Hastatus luridus* in all essential details.

Our knowledge of the relations of *Myxilla* to other genera does not rest on a very satisfactory basis (see under *Plumohalichondria* and *Clathria*, with which genera, as well as—perhaps more distantly—with *Hymedesmia* and *Hymerrhaphia*, it presents considerable affinities).

[1] Bronn's Klass. u. Ordnung. des Thierreichs, Porifera, p. 349.
[2] The "internal defensive spicula" of Bowerbank.
[3] Notes Leyden Mus., vol. ii. p. 127.

Myxilla rosacea, Lieberkühn, sp., var. *japonica*, nov. (Pl. XXVI. fig. 3; Pl. XXVII. figs. 8, 8*a*, 8*b*, 8*c*; Pl. XLVII. fig. 3).

1859. *Halichondria rosacea*, Lieberkühn, Archiv f. Anat. u. Physiol., vol. ix. p. 520, Taf. xi. fig. 2.
1862. *Myxilla rosacea*, Schmidt, Spong. Adriat. Meer., p. 71.
1862. *Myxilla fasciculata*, Schmidt (*non* Lieberkühn),[1] Spong. Adriat. Meer., p. 71.
1864. *Myxilla tridens*, Schmidt, Spong. Adriat. Meer., Suppl. i. p. 36.
1864. *Myxilla Esperii*, Schmidt, Spong. Adriat. Meer., Suppl. i. p. 36.

Sponge (Pl. XXVI. fig. 3) lobate or digitate; frequently flattened. The largest specimen is of an irregularly lobate form and 56 mm. in length. *Colour* in spirit very variable; ranging from very pale, creamy yellow to almost quite black. *Texture* firm, compact and rather leathery. *Surface* uneven, corrugated, and sometimes minutely hispid. *Dermal membrane* very thin and transparent. *Pores* not very abundant, scattered. *Oscula* few, small, scattered.

Skeleton.—The main skeleton consists of a very compact and symmetrical reticulation; when seen in thin section (Pl. XLVII. fig. 3) the network appears to be made up of a number of triangular meshes, the apices of six such triangles meeting in a common point while the bases form a hexagon; this arrangement is in places very distinctly visible but is, of course, never mathematically exact. The sides of the triangular meshes are of exactly one spicule's length, and are formed of from one to about six stylote spicules lying side by side. There is no proper dermal reticulation, but at a depth of about 0·14 mm. below the dermal membrane the skeleton arrangement just described suddenly gives place to another and totally different one. This takes the form of a number of brushes of tornote spicules, each brush only one spicule in length, and with the component spicules diverging upwards towards the dermal membrane, which they support, and through which their points often project for a short distance.

Spicules.—(*a*) *Megasclera;* of two kinds. (1) Entirely spined, short, slightly curved styli (Pl. XXVII. figs. 8, 8*a*) tapering rather suddenly to a sharp point at the apex, size about 0·14 by 0·0126 mm. (the diameter is very variable, that given is about the maximum), making up the main skeleton; (2) smooth, hastately pointed tornota (Pl. XXVII. figs. 8*b*. 8*c*) rather thicker in the centre than elsewhere, size about 0·175 by 0·007 mm., occurring in brushes supporting the dermal membrane. (*b*) *Microsclera;* of two kinds—(1) small, tridentate isochelæ, with rather strongly curved shaft, which appears to be slightly expanded laterally, especially towards the two ends; length up to about 0·03 mm.; (2) slender sigmata, usually much contort, length up to about 0·045 mm.

This sponge differs from Schmidt's types of the species chiefly in the possession of a shorter, stouter, and more strongly spined stylote spicule; in Schmidt's types, also, the

[1] According to Vosmaer, Notes Leyden Mus., vol. ii. p. 123, 1880.

ends of the tornote spicules may sometimes become flattened and slightly spined. The Challenger variety, again, has a firmer and more regular skeleton.

Neither Lieberkühn nor Schmidt (*loc. cit.*) mention the chelate spicules, but Vosmaer[1] records their presence, and we have ourselves found them in one of Schmidt's specimens now in the British Museum.

Lieberkühn and Schmidt obtained their specimens from the Mediterranean, and it is of considerable interest to find an only very slightly modified variety occurring at Japan.

Locality.—Kobé, Japan; depth, 8 to 50 fathoms. Three specimens and some fragments.

Habitat.—Mediterranean (Lieberkühn, Schmidt); Japan (Challenger).

Myxilla digitata, Ridley and Dendy (Pl. XXVI. fig. 2; Pl. XXVII. figs. 5, 5*a*, 5*b*).

1886. *Myxilla digitata*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 471.

Sponge (Pl. XXVI. fig. 2) represented in the collection by a single specimen, about 31 mm. long and 12 mm. broad, cleft at the upper end into five finger-like lobes, whence the specific name. *Colour* in spirit greyish-yellow. *Texture* soft and spongy. *Surface* smooth but uneven and corrugated. *Dermal membrane* distinct, thin, transparent. *Oscula* small, scattered, having their margins flush with the surface. *Pores* scattered.

Skeleton.—(*a*) *Dermal;* consisting of tylote spicules loosely scattered in the dermal membrane. (*b*) *Main;* a close but irregular and somewhat Halichondrioid reticulation of spined stylote spicules. Fibres very indefinite.

Spicules.—(*a*) *Megasclera;* (1) entirely spined styli (Pl. XXVII. fig. 5), usually slightly curved and tapering gradually to not very sharp points, with no tendency to the formation of heads and with the base no more spined than the remainder of the spicule; spination well marked; size about 0·4 by 0·014 mm.; (2) tylota (Pl. XXVII. fig. 5*a*), straight and with well-developed heads; size about 0·24 by 0·006 mm. (*b*) *Microsclera;* of one kind only, viz., tridentate isochelæ (Pl. XXVII. fig. 5*b*), with strongly curved shaft; length about 0·044 mm.

This species is readily distinguished from *Myxilla* (*Hymeniacidon*) *paupertas*, Bk., with which it agrees in several respects, by the absence of the echinating stylote spicules.

Locality.—Station 142, December 18, 1873; lat. 35° 4′ S., long. 18° 37′ E.; south of the Cape of Good Hope; depth, 150 fathoms; bottom, green sand; bottom temperature, 47°·0. One specimen.

[1] Notes Leyden Mus., vol. ii. p. 124, 1880.

Myxilla paucispinata, Ridley and Dendy (Pl. XXVII. figs. 2, 2*a*, 2*b*, 2*c*; Pl. XXX. fig. 3).

1886. *Myxilla paucispinata*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 471.

Sponge (Pl. XXX. fig. 3) massive, amorphous, cavernous.[1] *Colour* in spirit pale yellow. *Texture* rather soft, very brittle and fragile. *Surface* very uneven and roughly hispid from the presence of numerous large foreign (Hexactinellid) spicules; with numerous apertures leading into canals; some of these apertures are undoubtedly oscula, each being surrounded by a fringe of spicules. The surface also presents circular areas, in each of which the parchment-like *dermal membrane* covers over an underlying cavity; these are possibly in part pore-areas, but we have not succeeded in demonstrating the fact, and have offered below what seems to be a more likely explanation of their presence. The *Oscula* are in the centres of similar looking areas and are thickly fringed by radiating brushes of tylote spicules, which occur chiefly in this position and also, in fewer numbers, in the circular areas above mentioned. *Pores* (?).

Skeleton.—(*a*) *Dermal;* a close, irregular reticulation of large stylote spicules similar to those of the main skeleton, with a small admixture of tylota.[2] Within a certain radius of the oscula the stylote spicules abruptly and entirely disappear and give place to thick brushes of the tylota; these converge towards the osculum, the margin of which is fringed by the free ends of the terminal spicules of the brushes. The stylote spicules are also absent from the circular areas above described, their place being taken by a few tylota which sometimes show an incipient radiate arrangement; from these considerations it seems not improbable that some, at any rate, of the spaces mentioned mark the positions of future oscula. (*b*) *Main;* this consists of an irregular but close reticulation of stylote spicules in which no fibre is developed.

Spicules.—(*a*) *Megasclera;* of two kinds. (1) Large, stout styli (Pl. XXVII. fig. 2) usually curved, with rather blunt apex and not infrequently slightly spined; size about 0·7 by 0·031 mm. (2) Tylota (Pl. XXVII. fig. 2*a*) each with a fairly straight shaft bearing a distinct, though only slightly developed, oval head at each end; entirely smooth; size about 0·4 by 0·008 mm. (*b*) *Microsclera;* of two kinds. (1) Tridentate isochelæ (Pl. XXVII. figs. 2*b*, 2*c*), with stout, strongly curved shaft; length about 0·05 mm. (2) Slender sigmata, simple and contort, varying a good deal in size, up to about 0·056 mm. long.

Unfortunately there is only a single piece of this sponge in the collection, and that in very poor condition. It is encrusted in places by a thin, black, coating sponge

[1] With embedded Polychæte worms, to which the exceedingly cavernous nature may be in part due. One large tunnel penetrates right through the sponge, which is perhaps only a fragment.

[2] It is possible that the tylota alone form the true dermal skeleton and that the styli are merely an upper layer of the main skeleton; this would explain the absence of styli immediately around the oscula. Compare with this the dermal skeleton in *Myxilla cribrigera*, nobis.

(Pl. XXX. fig. 3, *e*), which proves to be a new species, characterised by remarkably fine microsclera; it will be found described on p. 84 under the name *Esperiopsis pulchella*.

The spination of the styli appears to be a very inconstant character in this species (*vide infra*), and it is doubtful whether it is of even specific value; nevertheless we have made use of the fact that these spicules may be spined in selecting a name for the species. This consideration tends to throw considerable doubt on the correctness of separating genera, *e.g.*, *Tedania* and *Trachytedania*, on this character alone.

Locality.—Station 192, September 26, 1874; lat. 5° 49′ 15″ S., long. 132° 14′ 15″ E.; Little Ki Island, New Guinea; depth, 140 fathoms; bottom, blue mud. One specimen.

A second specimen in the collection is probably a slight variety of the above. It is, however, a mere fragment, but it comes from the same station. The spiculation is as follows:—(*a*) *Megasclera;* (1) large, smooth styli, with fairly sharp points (seldom or never showing spination); measuring about 0·77 by 0·028 mm.; (2) tylota, with very well developed, oval heads; measuring about 0·42 by 0·0078 mm. (*b*) *Microsclera;* (1) tridentate isochelæ, with slightly curved shaft; length about 0·063 mm.; (2) large, slender, simple (very rarely contort) sigmata, up to about 0·145 mm. in length.

Myxilla mollis, Ridley and Dendy (Pl. XXVII. figs. 4, 4*a*, 4*b*).

1886. *Myxilla mollis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 471.

Sponge massive, amorphous. Largest specimen about 62 mm. long by 31 mm. broad and 12 to 19 mm. thick. *Colour* in spirit pale, creamy yellow. *Texture* uniform throughout, very soft and spongy. *Surface* usually very uneven, but smooth. *Dermal membrane* distinct, thin, transparent. *Oscula* scattered, having their margins flush with the surface of the sponge. *Pores* scattered (?).

Skeleton.—(*a*) *Dermal;* composed of loosely scattered tylote spicules, together with a certain proportion of styli; sometimes forming a very irregular reticulation, in which occasionally several spicules are found lying side by side, parallel with one another. (*b*) *Main;* as loose and irregular as the dermal layer, consisting of a very indefinite reticulation of stylote or subtylostylote spicules.

Spicules.—(*a*) *Megasclera;* of two kinds. (1) Smooth subtylostyli or styli (Pl. XXVII. fig. 4); these form the main skeleton and are generally subtylostylote, being more or less enlarged at the base, and tapering more or less gradually to a sharp point at the apex; size about 0·42 by 0·01 mm.; (2) tylota (Pl. XXVII. fig. 4*a*), each with a straight, slender shaft and a distinct oval head at each end; entirely smooth; measuring about 0·22 by 0·006 mm.; occurring abundantly in the dermal layer of the skeleton. (*b*) *Microsclera;* (1) tridentate isochelæ (Pl. XXVII. fig. 4*b*), with slightly curved shaft which, towards the two ends, often appears to be expanded on each side into a slight fimbria; length

about 0·04 mm.; (2) simple and contort sigmata, measuring up to about 0·063 mm. in length, but varying greatly in this respect.

This species resembles *Halichondria isodictyalis* of Carter,[1] but the chelæ, sigmata and styli are all smaller in that species than here, and further, the head of the stylus is smaller than the shaft.

Locality.—Off the south-west coast of Patagonia (Station 308 or 311, or both). Five specimens.

Myxilla spongiosa, Ridley and Dendy (Pl. XXVII. figs. 3, 3*a*, 3*b*, 3*c*, 3*d*, 3*e*, 3*f*).

1886. *Myxilla spongiosa*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 471.

Sponge massive, encrusting, growing all round a worm-tube, which it encrusts for a length of 69 mm. and to a thickness of about 12 mm. in the middle. *Texture* extremely soft and spongy. (The condition of the sponge is so bad that no further account of the external characters is practicable.)

Skeleton.—(*a*) *Dermal;* a thick but confused reticulation of scattered tylote spicules. (*b*) *Main;* a very confused reticulation of smooth styli.

Spicules.—(*a*) *Megasclera;* of two kinds; (1) smooth, stout, slightly curved styli (Pl. XXVII. fig. 3), tapering gradually to a sharp point at the apex; size about 0·7 by 0·02 mm.; making up the main skeleton. (2) Tylota (Pl. XXVII. figs. 3*a*, 3*b*), with well-developed oval heads, usually (? invariably) minutely spined at the end; size up to about 0·4 by 0·01 mm.; dermal. (*b*) *Microsclera;* of two kinds; (1) tridentate isochelæ (Pl. XXVII. figs. 3*c*, 3*d*), with the shaft laterally expanded towards each end; length about 0·05 mm. (2) Rather stout sigmata (Pl. XXVII. figs. 3*e*, 3*f*), usually much contort; size about 0·063 by 0·0045 mm. Both kinds of microsclera are abundant.

The condition of this specimen unfortunately prevents more detailed description, but the spiculation is sufficient to distinguish it from other species; it will be seen to approach *Myxilla mollis*, nobis, in this respect, but differs in details. Besides having the stylus smooth, as in *Myxilla mollis*, the species further diverges from the more normal character of *Myxilla* in the large size of the megasclera and chelæ.

Locality.—Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; off the mouth of the Rio de la Plata; depth, 600 fathoms; bottom, green sand; bottom temperature, 37°·2. One specimen.

Myxilla hastata, Ridley and Dendy (Pl. XXVII. figs. 1, 1*a*, 1*b*, 1*c*).

1886. *Myxilla hastata*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 472.

Sponge forming a flattened lamella, the shape of which cannot be ascertained, as there are only fragments in the collection. The largest piece measures about 69 mm. by

[1] *Ann. and Mag. Nat. Hist.*, ser. 5, vol. ix. p. 285.

62 mm. and is about 6 mm. thick; it is strongly curved. (The colour is now reddish, but this is due to the rusting of the case in which the sponge was packed, which has also affected many other specimens from the same station.) *Texture* soft and spongy. *Surface*, on one (the convex) side very rough and uneven, with a worn appearance, on the other slightly rough and longitudinally wrinkled. *Pores* oval, about 0·03 mm. in long diameter, in irregular groups.

Skeleton.—(*a*) *Dermal*; the dermal membrane is supported on the ends of brushes of tornote spicules which radiate outwards from below the surface of the sponge; these spicules may also occur scattered horizontally through the dermal membrane. (*b*) *Main*; the main skeleton is a very loose and confused reticulation of large, smooth, stylote spicules, with a tendency towards the formation of incipient fibre.

Spicules.—(*a*) *Megasclera*; of two kinds. (1) Large, stout, slightly curved, sharply and gradually pointed, smooth styli (Pl. XXVII. fig. 1), size about 0·77 by 0·04 mm. (2) Hastately pointed, smooth tornota (Pl. XXVII. figs. 1*a*, 1*b*), size about 0·35 by 0·01 mm.; dermal. (*b*) *Microsclera*; of two kinds. (1) Tridentate isochelæ (Pl. XXVII. fig. 1*c*), with stout, strongly curved shaft; length up to about 0·04 mm., but more usually about 0·025 mm.; abundant. (2) Very abundant sigmata, rather stout and often much contort, size about 0·07 by 0·004 mm.

This species evidently comes very close to *Myxilla spongiosa*, nobis, from the same station, but is sharply marked off from it by the form of the dermal spicules (perhaps also by their arrangement), by the greater stoutness of the stylus, and by the difference in size and shape of the tridentate isochelæ, as well, perhaps, as by the general form of the sponge.

Locality.—Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; off the mouth of the Rio de la Plata; depth, 600 fathoms; bottom, green sand; bottom temperature, 37°·2. One specimen.

Myxilla cribrigera, Ridley and Dendy (Pl. XXVII. figs. 7, 7*a*, 7*b*).

1886. *Myxilla cribrigera*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 472.

Sponge apparently free; digitate, consisting of a single long, digitate process arising from a shorter, stouter, transverse piece. Total length of sponge 50 mm.; length of the transverse piece 31 mm.; diameter of main lobe about 12 mm. *Colour* in spirit dark, yellowish-grey. *Texture* soft and spongy. *Surface* minutely and irregularly hispid. *Dermal membrane* very distinct, thin, transparent, often readily separating from the underlying tissues. *Oscula* small, scattered, with their margins flush with the surface (?). *Pores* arranged in definite, more or less circular pore-areas. The surface of the sponge presents in many places distinct rounded areas, marking the position of subdermal cavities covered over only by the thin, transparent dermal membrane, which is in these places penetrated by very large, oval pores. These cribriform areas, and even the pores

themselves, are visible to the naked eye. Diameter of pore-areas about 1 mm.; of the pores themselves very variable, averaging about 0·1 mm., but may be much greater.

Skeleton.—(*a*) *Dermal;* when pieces of the dermal membrane are peeled off from the surface of the sponge, as is easily done, and examined separately, the only true skeleton they possess is seen to consist of rather sparsely scattered tylote spicules; sometimes, however, the styli belonging to the underlying main skeleton project beyond the surface of the sponge, giving to it its irregularly hispid character. (*b*) *Main;* consisting of a very loose and irregular reticulation of styli, often forming loose fibres which run towards the surface and are crossed more or less at right angles by others.

Spicules.—(*a*) *Megasclera;* of two kinds. (1) Smooth, stout styli (Pl. XXVII. fig 7), only slightly curved, measuring about 0·65 by 0·025 mm. (2) Tylota (Pl. XXVII. fig. 7*a*), with straight shaft and an oval head at each end; the head is sometimes very slightly spined at the top, where it may also be slightly flattened. Usually one end of the spicule is a little larger than the other. Size about 0·3 by 0·008 mm. (*b*) *Microsclera;* one kind only present; viz., large, tridentate isochelæ (Pl. XXVII. fig. 7*b*), with a slightly curved shaft which is markedly expanded laterally towards each end; length about 0·08 mm. These are plentiful in the dermal membrane and also occur scattered through the deeper tissues of the sponge.

Perhaps the most striking features of this sponge are the great size of the pores and their arrangement in definite pore-areas. These strongly resemble the corresponding structures in *Halichondria forcipis*, Bk., as described and figured by Carter.[1] The species differs markedly from the two preceding ones in the absence of sigmata.

Its spiculation agrees in *kind* with that of *Cribrella hamigera*, Schmidt,[2] but in that species the styli tend to develop heads, and the spicules throughout are merely the miniatures of those of this species.

Locality.—Station 306A, January 2, 1876; lat. 48° 27′ S., long. 74° 30′ W.; off the south-west coast of Patagonia; depth, 345 fathoms; bottom, blue mud; bottom temperature, 46°. One specimen.

Myxilla fusca, Ridley and Dendy (Pl. XXVII. figs. 11, 11*a*, 11*b*).

1886. *Myxilla fusca*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 472.

Sponge massive, amorphous, the largest specimen about 19 mm. in greatest diameter. *Colour* in spirit darkish brown. *Texture* fairly firm and elastic, but rather coarse. *Surface* uneven, in places minutely hispid. *Dermal membrane* adhering firmly to the underlying tissues; thin, granular and pigmented, brown in colour but translucent. *Pores* apparently collected into pore-areas, wherein they reduce the dermal

[1] *Ann and. Mag. Nat. Hist.*, ser. 4, vol. xiv. p. 246, pl. xiv. fig. 29, *a*.
[2] Spong. Adriat. Meer., p. 70, pl. vi. fig. 13.

membrane to a network, but we have found no perfect examples of this arrangement. *Oscula* small and scattered, having their margins usually sunk a little below the general surface of the sponge.

Skeleton.—(*a*) *Dermal;* consisting of a very irregular layer of tylote spicules, scattered, or in loose bundles and brushes which may commence beneath the surface and project outwards. (*b*) *Main;* a very irregular reticulation of entirely spined styli. No very distinct fibres are present, although primary lines of spicules may be recognised, with little difficulty, running vertically towards the surface.

Spicules.—(*a*) *Megasclera;* (1) entirely spined styli (Pl. XXVII. fig. 11), with the spination well marked, usually slightly curved and sharply pointed at the apex, size about 0·52 by 0·034 mm. (2) Tylota (Pl. XXVII. fig. 11*a*), with heads only faintly developed, entirely smooth, with straight shaft and well-rounded ends, size about 0·42 by 0·01 mm. We have not found any distinct echinating spicules, although sometimes entirely spined styli, much smaller than those described, occur, which may perhaps represent them. (*b*) *Microsclera;* (1) tridentate isochelæ (Pl. XXVII. fig. 11*b*), with strongly curved shaft and of rather peculiar shape, length about 0·047 mm. (2) Very slender sigmata, usually much contort, length about 0·05 mm. Neither kind of microsclera occurs very abundantly.

This sponge, represented in the collection only by two small pieces, closely resembles in external appearance an *Iophon*, and may readily be distinguished from other *Myxillæ* by its dark colour (should this prove to be a constant feature of the species). It is distinguished from *Myxilla paupertas*, Bk., and *Myxilla nobilis*, nobis, by the presence of the sigmata, the entire spination of the large stylus, and the absence of the echinating stylus; and from the latter also by the fact that the tylota are smoothly rounded off at the ends. The sponge contains a considerable amount of foreign matter, chiefly Foraminifera.

Locality.—Station 150, February 2, 1874; lat. 52° 4′ S., long. 71° 22′ E.; west of Heard Island, Southern Ocean; depth, 150 fathoms; bottom, coarse gravel; bottom temperature, 35°·2. Two specimens.

Myxilla mariana, Ridley and Dendy (Pl. XXVII. figs. 12, 12*a*, 12*b*, 12*c*, 12*d*).

1886. *Myxilla mariana*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 472.

Sponge massive; represented in the collection only by a few fragments, the largest of which is about 25 mm. long by 12 mm. broad. *Colour* in spirit very pale, yellowish-grey. *Texture* fairly compact, but soft and rather crumbling. *Surface* smooth, more or less glabrous, but very uneven and deeply furrowed by wide meandering grooves, so as to give rise to a number of irregular, stumpy lobes. *Dermal membrane* thin, transparent, adhering rather firmly to the underlying tissues. *Pores;* these appear to be rather scarce, and we have observed no definite pore-areas. *Oscula* small and scattered.

Skeleton.—(*a*) *Dermal;* consisting of a layer of irregularly but very thickly scattered tylota; these spicules may also be found in irregular, short, thick fibres or brushes, disposed at right angles to the surface immediately beneath the dermal membrane. (*b*) *Main;* an abundant but very irregular and ill-defined reticulation of spined styli, sparsely echinated by smaller spined styli. No very distinct fibres are found, although traces of such occur running vertically towards the surface of the sponge.

Spicules.—(*a*) *Megasclera;* of three kinds. (1) Entirely spined styli (Pl. XXVII. fig. 12), usually slightly curved and tapering gradually to a very sharp point at the apex; with the spination distinct but not very strongly pronounced and most developed about the base; size about 0·42 by 0·016 mm.; making up the main skeleton. (2) A few, much smaller, entirely spined styli or subtylostyli (Pl. XXVII. fig. 12*a*), usually straight and tapering gradually from the base to a sharp point at the apex, size about 0·16 by 0·0125 mm.; echinating the main skeleton. (3) Tylota (Pl. XXVII. figs. 12*b*, 12*c*), entirely smooth, with straight shaft and not very strongly marked oval heads narrowing towards the end; size about 0·3 by 0·0094 mm.; the heads of these spicules are often more strongly developed at one end of the shaft than at the other, a character, however, which is by no means peculiar to the species in question. (*b*) *Microsclera;* (1) tridentate isochelæ,[1] (Pl. XXVII. fig. 12*d*), with only slightly curved shaft; length very variable, up to about 0·04 mm. (2) Slender, usually much contort sigmata, length up to about 0·057 mm.

This sponge comes near to *Myxilla fusca*, nobis, but is doubtless distinct, as indicated by the great difference in size of the larger spined styli and perhaps by the absence of echinating spicules in that species; a very important distinction also lies in the forms of the chelæ of the two species (*cf.* figs. 11*b* and 12*d*, Pl. XXVII.).

Locality.—Off Marion Island; depth, 50 to 75 fathoms. A few fragments.

Myxilla mariana, var. *massa*, Ridley and Dendy (Pl. XXVII. figs. 6, 6*a*, 6*b*, 6*c*, 6*d*, 6*e*, 6*f*).

1886. *Myxilla mariana*, var. *massa*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 473.

Sponge massive, amorphous. The type specimen is irregularly globular in shape and about 37 mm. in diameter. *Colour* in spirit yellow. *Texture* soft and spongy. *Surface* very uneven, but not hispid. *Dermal membrane* very well developed, thin and transparent. *Pores* large and exceedingly numerous, plainly visible to the naked eye, collected in large, irregular groups over the subdermal cavities, reducing the dermal membrane in these places to a mere network. *Oscula* small, scattered, with their margins flush with the surface of the sponge.

Skeleton.—(*a*) *Dermal;* scattered through the dermal membrane are a great number

[1] Occasionally a four-toothed isochela is found.

of straight tylote spicules; these spicules, just beneath the surface of the sponge, are collected into loose, irregular fibres, which break up into tufts of spicules on approaching the dermal membrane. (*b*) *Main;* a very irregular, somewhat Halichondrioid reticulation of spined styli, echinated by much smaller spined styli. There is no very distinct fibre, though in places there appears to be a tendency towards the radiate arrangement characteristic of Bowerbank's genus *Microciona*.

Spicules.—(*a*) *Megasclera;* (1) long, slender, straight or slightly curved, entirely spined styli (Pl. XXVII. figs. 6, 6*a*), tapering very gradually to a fine point at the apex, measuring about 0·42 by 0·01 mm. (2) Much smaller, usually straight, entirely spined styli (Pl. XXVII. figs. 6*d*, 6*e*), tapering gradually from base to apex and finely pointed, size usually about 0·14 by 0·0065 mm.; distinguished from the preceding by their position (echinating), their smaller size, and the fact that they are more strongly spined. (3) Straight tylota (Pl. XXVII. figs. 6*b*, 6*c*), with usually distinct, elongated, oval heads, often narrowing towards the end; size about 0·28 by 0·0045 mm. (*b*) *Microsclera;* (1) tridentate isochelæ (Pl. XXVII. fig. 6*f*), with slightly curved shaft; length about 0·037 mm. (2) Slender sigmata, usually much contort; length about 0·056 mm. ((?) (3) A few scattered, long, straight, hair-like, oxeote rhaphides; length about 0·35 mm. It is possible that these spicules may have been taken in by the sponge as foreign bodies, and that they really belong to some of the *Tedaniæ* which occur at the same locality).

Rejecting the long hair-like spicules as young forms or foreign, this sponge differs from the type of the species only in the comparative slenderness of the megasclera. The species comes very close in spiculation to *Myxilla* (*Microciona*) *bihamigera*, Waller.[1] In the latter, however, the megasclera are all smaller and the diactinal spicules without heads (hastately pointed), while the isochelæ are described as being palmate; the habit and the arrangement of the main skeleton also differ in the two species.

Locality.—Off the south-west coast of Patagonia. One specimen.

Myxilla compressa, Ridley and Dendy (Pl. XXVII. figs. 9, 9*a*, 9*b*, 9*c*, 9*d*, 9*e*).

1886. *Myxilla compressa*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 473.

Sponge massive (?), flattened. The largest piece in the collection is about 56 mm. long by 25 mm. wide and 4 mm. thick. *Colour* in spirit yellowish-grey. *Texture* soft and spongy. *Surface* smooth where the dermal membrane is still intact, but the subdermal cavities show very distinctly through the transparent membrane and give to the sponge a honeycombed appearance. *Dermal membrane* distinct, thin and transparent. *Oscula* small and scattered, having their margins flush with the surface of the sponge. *Pores* collected in groups—pore-areas—in those portions of the dermal membrane which cover the subdermal cavities. The pores are round or oval and average about 0·2 mm. in diameter.

[1] *Journ. Quekett Micr. Club*, vol. v. p. 1, pls. i., ii., 1878–79.

Skeleton.—(*a*) *Dermal;* consisting of scattered tylota, sometimes arranged in irregular brushes. (*b*) *Main;* arranged very much as in *Myxilla rosacea*, var. *japonica*, but not so firm and dense; the meshes of the spicular network are triangular and the side of each triangle is of one spicule's length, and usually composed of several spined styli lying together parallel with one another, the rudimentary fibre thus formed being echinated, chiefly at the nodes, by smaller spined styli.

Spicules.—(*a*) *Megasclera;* of three kinds. (1) Entirely and considerably spined, almost or quite straight, sharply pointed styli (Pl. XXVII. figs. 9, 9*a*), measuring about 0·28 by 0·0155 mm., making up the main skeleton. (2) Much smaller, straight, very sharply pointed and entirely spined styli (Pl. XXVII. fig. 9*b*), measuring about 0·12 by 0·008 mm., echinating the skeleton fibre. (3) Tornota or tylota (Pl. XXVII. fig. 9*c*), somewhat hastately pointed or with slightly developed, smooth, oval heads, pointed at the ends; size about 0·22 by 0·0063 mm., dermal. (*b*) *Microsclera;* (1) tridentate isochelæ (Pl. XXVII. figs. 9*d*, 9*e*) of rather peculiar form, and with very strongly curved shaft; length about 0·044 mm. Numerous much smaller isochelæ also occur which at first sight appear to be different in shape, but they are probably merely young forms of the larger. The isochelæ are extremely abundant, especially in the dermal membrane, forming in places an almost continuous layer. (2) Very small and very slender sigmata, usually contort and much bent, length usually about 0·02 mm., very rarely up to 0·063 mm.

The external appearance of the sponge and the shape of the isochelæ are well-marked characters of this species, and serve to distinguish it from others of the genus.

Locality.—Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; off the mouth of the Rio de la Plata; depth, 600 fathoms; bottom, green sand; bottom temperature, 37°·2. Six or eight pieces, mostly in a rather fragmentary condition.

Myxilla nobilis, Ridley and Dendy (Pl. XXVII. figs. 15, 15*a*, 15*b*, 15*c*, 15*d;* Pl. XXX. figs. 2, 2*a*).

1886. *Myxilla nobilis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 473.

Sponge (Pl. XXX. fig. 2) massive or lobate, may be encrusting. The largest specimen consists of two lobes, a large one and a small one, arising from a common base; the base is about 56 mm. long by 25 mm. broad and the larger lobe is 56 mm. in height. Another specimen encrusts the branches of a dead Coral. *Colour* in spirit greyish-yellow. *Texture* loose, soft and spongy; rather cavernous. *Surface* uneven but not hispid. *Dermal membrane* very distinct, transparent, glabrous; easily separable from the underlying tissues. *Oscula;* round, scattered openings, having their margins flush with the general surface of the sponge. *Pores* very distinct, arranged for the most part in very

definite, rounded or oval pore-areas (Pl. XXX. fig. 2*a*) about 1 mm. in diameter; these pore-areas are often very thickly scattered over the surface of the sponge, being separated from one another only by thin strands of tissue. The dermal membrane within the pore-areas is reduced to a fine, lace-like network by the presence of numerous large pores, of which from thirty to forty often occur in a single pore-area. The pores themselves are rounded openings, usually oval, but often more or less polygonal and varying in greatest diameter from 0·07 to 0·35 mm.

Skeleton.—(*a*) *Dermal;* a loose reticulation of scattered tylota, often arranged in small brushes, in a radiate manner, around the pore-areas. (*b*) *Main;* a very loose and irregular reticulation of styli, united together in parts to form loose fibres; rather abundantly echinated by smaller, spined styli.

Spicules.—(*a*) *Megasclera;* of three kinds. (1) Styli (Pl. XXVII. fig. 15), entirely smooth or slightly spined at the base; stout, usually slightly curved, and tapering gradually to a very sharp point at the apex; size about 0·52 by 0·03 mm; making up the main skeleton. (2) Much smaller, entirely spined styli (Pl. XXVII. fig. 15*a*), usually straight, tapering gradually from the base to a sharp point at the apex; with the spination more pronounced at the base than elsewhere, and often with distinct heads (tylostylote); size about 0·18 by 0·013 mm.; echinating the loose fibres of the main skeleton. (3) Tylota (Pl. XXVII. fig. 15*b*), with straight, smooth shaft and slightly expanded heads, which are very short and abruptly truncated, often slightly spined at the end; size about 0·33 by 0·0063 mm.; dermal. (*b*) *Microsclera;* tridentate isochelæ (Pl. XXVII. figs. 15*c*, 15*d*), with strongly curved, stout shaft; variable in size, measuring up to about 0·044 mm. in length; exceedingly abundant, especially in the dermal membrane. Occasionally smooth, simple sigmata are seen, about 0·09 mm. long, but so rarely as to suggest that they probably occur only as foreign bodies.

A remarkable feature of this species is the frequent truncation of the heads of the tylota, often accompanied by minute spination. This, however, is not a constant feature and may sometimes be observed in *Myxilla rosacea*, Schmidt; it may also occur in *Myxilla cribrigera*, nobis. The two species, *Myxilla cribrigera* and *Myxilla nobilis* agree closely in several respects, but are sharply distinguished from one another by the fact that the former has no echinating spined styli such as are present in the latter.

Another very interesting point is the transitional character of the larger stylote spicule; it is apparently normally smooth, but may be slightly spined (*cf. Myxilla paucispinata*, nobis, p. 132).

Localities.—Station 148A, January 3, 1874, lat. 46° 53′ S., long. 51° 52′ E.; south of the Crozets; depth, 240 to 550 fathoms; bottom, hard ground, gravel, shells. One specimen, apparently a piece broken off from a larger one. Probably belonging to a slight geographical variety.

Station 320, February 14, 1876; lat. 37° 17′ S., long. 63° 52′ W.; off the mouth of

the Rio de la Plata; depth, 600 fathoms; bottom, green sand; bottom temperature, 37°·2. Three specimens (being the three which we regard as most typical of the species and from which the above description is taken).

Myxilla nobilis, var. *patagonica*, Ridley and Dendy (Pl. XXVII. figs, 13, 13*a*, 13*b*).

1886. *Myxilla nobilis*, var. *patagonica*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 473.

Sponge massive, amorphous. Size of largest specimen 37 mm. long by 19 mm. broad and 12 mm. thick. *Colour* in spirit light, yellowish-brown. *Texture* soft and crumbling. *Surface* uneven, rugose, traversed by meandering furrows, calling to mind the appearance of the Brainstone Coral (*Mæandrina*). *Dermal membrane* distinct, delicate, transparent. *Oscula* and *Pores* not observed.

Skeleton.—(*a*) *Dermal;* very feebly developed, consisting of scattered tylota. (*b*) *Main;* a roughly Halichondrioid reticulation of styli, with irregularly rectangular meshes, about one spicule's length in breadth. The rudimentary fibres, which are almost devoid of horny cementing substance, are echinated, more especially at the nodes, by smaller, spined styli, the bases of which rest upon the fibre.

Spicules.—(*a*) *Megasclera;* of three kinds. (1) Basally spined styli (Pl. XXVII. fig. 13), sometimes verging upon the tylostylote form; usually more or less curved and tapering gradually to a sharp point at the apex; size about 0·42 by 0·02 mm.; making up the main skeleton. (2) Much smaller styli (Pl. XXVII. fig. 13*b*), often with distinct heads (tylostylote); entirely spined, but more so at the base than elsewhere; usually straight; size up to about 0·175 by 0·01 mm., echinating the skeleton fibre at the nodes. (3) Tylota (Pl. XXVII. fig. 13*a*), long and slender, and with but slightly marked oval heads. The heads are sometimes flattened at the ends (and with a very faint trace of spination ?). Size about 0·3 by 0·006 mm. Occurring scattered in the dermal membrane. (*b*) *Microsclera;* of one kind only, viz., tridentate isochelæ, with strongly curved shaft, length up to about 0·04 mm.

Locality.—Station 311, January 11, 1876; lat. 52° 45′ 30″ S., long. 73° 46′ 0″ W.; off the south-west coast of Patagonia; depth, 245 fathoms; bottom, blue mud; bottom temperature, 46°·0. One specimen (containing a good number of embryos scattered through it) and a few fragments.

Myxilla nobilis, var. *bacillifera*, Ridley and Dendy (Pl. XXVII. figs. 14, 14*a*, 14*b*).

1886. *Myxilla nobilis*, var. *bacillifera*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 473.

Sponge massive, amorphous. The largest specimen is irregularly globular in shape and about 25 mm. in diameter. *Colour* in spirit yellowish-grey. *Texture* very soft and spongy. *Surface* uneven, but not hispid. *Dermal membrane* distinct, very thin and

transparent. *Oscula* few, scattered, rather small. *Pores* arranged in definite, but rather irregular groups (pore-areas), each group containing about twenty or thirty, fairly closely placed, rounded or oval pores; diameter of pores about 0·1 mm.

Skeleton.—Very irregular; in parts one can distinguish primary lines of loose fibre running vertically to the surface of the sponge, crossed by still looser secondary fibres or by scattered spicules; in other parts the arrangement is even less regular and may be described as irregularly Halichondrioid. The fibre, such as it is, is composed of basally spined styli, and is echinated by much smaller, entirely spined styli (also in places by the larger styli ?). At the surface the main skeleton passes into loose fibres and brushes of tylota. The latter are abundantly present in the dermal membrane, excepting in the pore-areas, which are almost or quite free from spicules and have the tylota around them arranged in a radiate manner.

Spicules.—(*a*) *Megasclera;* of three kinds. (1) Basally spined styli (Pl. XXVII. fig. 14), sharply pointed and usually curved; size about 0·46 by 0·019 mm.; making up the main skeleton. (2) Much smaller, entirely spined styli (Pl. XXVII. fig. 14*a*), usually straight, sharply and very gradually pointed at the apex, sometimes with distinct heads (tylostylote); size about 0·175 by 0·0125 mm.; echinating the skeleton fibre. (3) Tylota (Pl. XXVII. fig. 14*b*), with straight shafts and very slight heads, which terminate very shortly and abruptly and are flattened and slightly spined at the ends; size about 0·3 by 0·006 mm.; dermal. (*b*) *Microsclera;* of one kind only, viz., tridentate isochelæ, with very strongly curved shafts; size variable, up to about 0·034 mm. long.

The most characteristic feature of this variety is the extent to which the flattening of the ends of the tylota is carried; the proportions of the large spined stylus also differ considerably from those of the corresponding spicule in the type specimens, as will be seen by reference to the descriptions.

Locality.—Station 307, January 4, 1876; lat. 49° 24′ 30″ S., long. 74° 23′ 30″ W.; off the south-west coast of Patagonia; depth, 140 fathoms; bottom, blue mud. Two specimens.

The species which we have called *Myxilla nobilis*, and its varieties, have given us a great deal of trouble in determining their true relations; they appear to be sufficiently connected *inter se* to warrant us in considering them all as varieties of one species, and that species perhaps finds its nearest already known ally in Bowerbank's *Hymeniacidon* (*Myxilla*) *paupertas;* the two species seem, however, to be distinct. Bowerbank appears to have had only very small and badly preserved specimens, about which nothing is satisfactorily known excepting the spiculation, which, as evidenced by one of his preparations in the British Museum, is as follows:—(1) Basally spined styli, verging upon tylostylote, curved, attenuated and drawn out very gradually into very fine points; size up to about 0·52 by 0·012 mm. (2) Entirely spined styli ("internal defensive

spicula," Bk.), but more spined at the base than elsewhere; usually curved, finely pointed; verging upon tylostylote; size up to about 0·2 by 0·0084 mm. (3) Very slender tylota, with very slightly developed heads, not spined nor flattened at the ends; size up to about 0·32 by 0·0047 mm. (4) Tridentate isochelæ,[1] with strongly curved shaft and divergent teeth; length about 0·04 mm.

The points in which Bowerbank's species differs from *Myxilla nobilis* will be readily seen by comparison of the descriptions; they concern more especially the form of the larger stylus and of the tylote spicule.[2]

Myxilla frondosa, Ridley and Dendy (Pl. XXVI figs. 1, 1*a*; Pl. XXVII. figs. 10, 10*a*, 10*b*, 10*c*, 10*d*, 10*e*, 10*f*).

1886. *Myxilla frondosa*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 473.

Sponge (Pl. XXVI. figs. 1, 1*a*) represented by a single broad, flattened frond, of somewhat oval shape, about 6 mm. thick, 100 mm. in height and 62 mm. in breadth. It has evidently grown in an erect position. *Colour* in spirit rather dark, yellowish-grey. *Texture* tough, fibrous, elastic. *Surface*, on one side, which is slightly convex, very rough, owing to the presence of thickly placed, small conuli, between which are the oscula. The other side is much smoother, the conuli are not so strongly pronounced, and the dermal membrane stretches over them continuously except where it appears to have been rubbed off. *Dermal membrane* distinct, thin and transparent. *Oscula* very numerous, small, round and thickly scattered over the convex surface, to which they appear to be confined; about 1 mm. in diameter. *Pores* very numerous, scattered, rounded openings in the dermal membrane on the concave surface, diameter variable, averaging about 0·2 mm. We have seen no pores on the other surface of the sponge.

Skeleton.—(*a*) *Dermal;* consisting of tylote spicules, which are for the most part irregularly scattered through the dermal membrane but are sometimes found in loose tufts. (*b*) *Main;* a very highly developed and compact reticulation of coarse, branching and sometimes anastomosing spiculo-fibre. The main lines of the skeleton, starting from the base, branch upwards in a dendroid manner, with their ramifications lying mainly in one plane, and giving off, approximately at right angles to this plane, very numerous, short branches which end in the conuli on the surface of the sponge. The fibre itself is stout and consists of closely placed styli which have their bases in the centre of the fibre and their apices directed very obliquely outwards and free, pointing towards the direction in which the fibre is running; there seems to be very little cementing substance uniting the spicules.

Spicules.—(*a*) *Megasclera;* (1) Entirely, but only slightly spined styli (Pl. XXVII.

[1] The figure of this spicule given by Bowerbank (Mon. Brit. Spong., vol. iii., pl. xxxvii. fig. 8) appears to us to convey a very erroneous idea of its true shape.

[2] *Cf.* Bk., Mon. Brit. Spong., vol. iii., pl. xxxvii. figs. 5, 6.

fig. 10), more spined at the base than elsewhere; slightly curved and tapering gradually to a sharp point at the apex; size about 0·6 by 0·03 mm., forming the main skeleton. It will be seen from their arrangement that all the spicules of the main skeleton are, in a sense, echinating, so that we cannot distinguish between an echinating and a non-echinating stylus as in some other *Myxillæ*. There are, however, a great many stylote spicules (Pl. XXVII. figs. 10*a*, 10*b*) which are much smaller (measuring about 0·28 by 0·013 mm.), and rather more strongly spined than those just described, but otherwise very like them in form, and these are perhaps to be regarded as representing the true echinating spicules; it may be urged that they are merely young forms of the larger ones, but their abundance and tolerable uniformity in size are against this view. (2) Tylota (Pl. XXVII. figs. 10*c*, 10*d*), usually slightly curved, rather stout, larger at one end than at the other, with oval heads (sometimes not distinguishable), and spined at both ends, size about 0·25 by 0·01 mm.; dermal. (*b*) *Microsclera;* of two kinds—(1) very numerous tridentate isochelæ (Pl. XXVII. fig. 10*e* 10*f*), of peculiar form, the most noticeable feature in which is the presence of a slight swelling in the centre of the curved shaft; length about 0·027 mm.; (2) sigmata, usually much contort, size about 0·044 by 0·004 mm.

The definite form, erect growth and elastic consistency of this sponge call to mind the genus *Clathria*, and the arrangement of the skeleton recalls *Plumohalichondria* rather than *Myxilla*, but the spiculation agrees very well with that of the genus to which we have referred it; in its genus it is further remarkable for the peculiar shape of its isochelate spicule.

Locality.—Station 170, 14 July, 1874; lat. 29° 55′ S., long. 178° 14′ W.; off Kermadec Islands; depth, 520 fathoms; bottom, volcanic mud; bottom temperature, 43°. One specimen.

Myxilla (*?*) *plumosa*, Montagu, sp., var. *fusifera*, nov.

1818. *Spongia plumosa*, Montagu, Mem. Wern. Soc. Edin., vol. ii. p. 116.
1842. *Halichondria* (*?*) *plumosa*, Johnston, British Sponges, p. 103
1866. *Microciona carnosa*, Bowerbank, Mon. Brit. Spong., vol. ii. p. 133.
1866. *Hymeniacidon plumosa*, Bowerbank, Mon. Brit. Spong., vol. ii. p. 195.
1867. *Pronax plumosa*, Gray, Proc. Zool. Soc. Lond., p. 536.
1870. *Desmacidon plumosa*, Schmidt, Spong. Atlant. Gebiet., p. 76.
1874. *Microciona plumosa*, Bowerbank, Mon. Brit. Spong., vol. iii. p. 61, pl. xxiv. figs. 7–13.
1880. *Myxilla plumosa*, Vosmaer, Notes from the Leyden Museum, vol. ii. p. 126.
1885. *Plumohalichondria plumosa*, Carter, Ann. and Mag. Nat. Hist., ser. 5, vol. xvi. p. 355.

Sponge irregularly lobate. The largest specimen consists of an elongated base, from which arise two lobes; length of base not quite 25 mm., height of larger lobe 25 mm., diameter about 8 mm. *Colour* in spirit pale, greyish yellow. *Texture* soft, spongy, elastic, rather tough and fibrous. *Surface* rather glabrous, but very uneven. *Dermal*

membrane fairly distinct, thin and transparent. *Oscula* (?). *Pores* scattered or in irregular groups.

Skeleton.—(*a*) *Dermal;* composed of thickly strewn, spined styli and fusiform oxea, the former sometimes predominating and the latter sometimes collected into distinct bands of fibre. (*b*) *Main;* composed of stout ropes of spined stylote spicules, abundantly echinated by numerous other spined styli apparently of the same kind. These fibres are not very regularly disposed and appear to originate from any foreign body which may form a convenient base, from which they radiate towards the surface, often branching in their course. In addition to these fibres, abundant, loosely scattered, spined styli occur.

Spicules.—(*a*) *Megasclera;* (1) small, usually curved, sharply pointed, entirely and strongly spined styli, varying in size from 0·1 by 0·008 to 0·16 by 0·013 mm. We have not been able to satisfy ourselves that there are really two distinct kinds of spined styli, although great variation in size occurs. (2) Fusiform oxea; slender, and tapering gradually to a very sharp point at each end; size about 0·175 by 0·0048 mm.; these spicules are probably homologous with the dermal spicules of typical *Myxillæ.* (*b*) *Microsclera;* of one kind only, viz., tridentate isochelæ, with very strongly curved shaft, length about 0·015 to 0·02 mm.

The Challenger variety differs from the British form chiefly in the possession of a more tapering oxeote spicule and a stouter isochela.

This species is very aberrant in its skeleton arrangement, resembling *Myxilla frondosa*, nobis, in this respect, and forming a connecting link between *Myxilla* and *Plumohalichondria.* It is only doubtfully that we include it in the former genus.

Locality.—Off Bahia, shallow water. One specimen and a fragment.

Genus *Clathria*, Schmidt (Pls. XXVIII., XXIX., XLVII.).

1862. *Clathria*, Schmidt, Spong. Adriat. Meer., p. 57.
1870. *Tenacia*, Schmidt, Spong. Atlant. Gebiet. p. 56.

Of various form, generally erect; possessing usually a well-developed horny fibre cored by stylote spicules and echinated by smaller spined styli. Typical microsclera small palmate isochelæ; no special dermal crust of spicules as in *Rhaphidophlus.*

Schmidt's original diagnosis (*loc. cit.*) runs as follows:—"Halichondriæ maxime ramosæ, ramis in modum clathrorum sæpissime inter se connexis. Substantia aciculas involvens subcornea, elastica dum aqua est imbuta, fragilis et fere friabilis, dum spongia est exsiccata. Rete microscopicum spiculorum, ista substantia conjunctorum maxime irregulare."

This, though very true so far as it goes, is obviously insufficient, and Vosmaer[1] in

[1] Notes from the Leyden Museum, vol. ii. p. 149.

1880 improves upon it with the following:—"Rods smooth or spined, 'echinating.' Anchors minute, equiended;" this also is very wide and really does not give so good an idea of the genus as Schmidt's original diagnosis. It has seemed to us advisable to restrict the genus by the diagnosis given above.

In 1880 (*loc. cit.*) Vosmaer placed *Clathria* amongst the Desmacidonidæ, saying:—"I have found that the genus *Clathria* of Schmidt possesses distinct, often very numerous anchors and bows; so it is to be placed under the Desmacidinæ;" this certainly appears a sensible arrangement, but in 1885 he adopts a different plan and places it apart from the Desmacidines, amongst the Ectyonidæ.[1] We have endeavoured to show elsewhere that the old Ectyonidæ and Desmacidonidæ must fall together in one group, being connected through the genus *Myxilla* (*cf.* p. 129), in which both species with and species without echinating spicules are found. The two genera *Clathria* and *Myxilla* seem to be nearly related, and our *Myxilla frondosa* forms an interesting connecting link.

The original type of the genus is *Clathria coralloides*, Schmidt (*loc. cit.*, p. 58), an Adriatic species; but this species is, unfortunately, not a very good example of the genus as now understood; the next one mentioned by Schmidt (*loc. cit.*), viz., *Clathria compressa*, appears to be much more typical. *Tenacia clathrata*, Schmidt,[2] is simply a *Clathria* with very great actual and relative development of the horny fibre.

Clathria appears to be essentially a shallow-water genus; and this fact is no doubt correlated with its horny fibre and fondness for warm seas; the slight exception presented by *Clathria inanchorata* (*vide infra*), from a depth of 120 fathoms, is associated with an aberrant spiculation.

The distribution of the genus is wide in tropical waters, but it seems to be best represented in the Indo-Australian area; as in the case of other horny sponges the genus attains its maximum of development in warmer climates.

Clathria aculeata, Ridley.

1884. *Clathria aculeata*, Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., p. 443, pl. xl. fig. 1; pl. xlii. fig. K.

This species was obtained by the "Alert" in Torres Strait, in which locality the Challenger also found it. It has already been sufficiently described and figured in the "Alert" report (*loc. cit.*).

Locality.—Station 186, September 8, 1874; lat. 10° 30′ S., long. 142° 18′ E.; Torres Strait; depth, 8 fathoms; bottom, Coral mud. One specimen.

Habitat.—Torres Strait, shallow water ("Alert" and Challenger).

[1] Bronn's Klass. u. Ordn. des Thierreichs, Porifera, p. 356.
[2] Spong. Atlant. Gebiet., p. 56.

Clathria decumbens, Ridley.

1884. *Clathria decumbens*, Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., p. 612, pl. liii. fig. K; pl. liv. figs. g, g'.

With this species we identify a washed out skeleton from Torres Strait; it differs slightly from the type in external form and in the proportions of the spicules, and the spines at the base of the smooth stylus are very rarely seen. It much resembles in external appearance specimens of *Acarnus ternatus* obtained by the "Alert" from the same locality, forming "a clathrous structure of round soft anastomosing trabeculæ."[1]

Locality.—Cape York, Torres Strait; August 7, 1874; depth, 3 to 11 fathoms. One specimen.

Habitat.—Boudeuse and Étoile Islands, Amirante Group, 10 to 13 fathoms (Ridley, "Alert"); Torres Strait (Challenger).

Clathria lendenfeldi, Ridley and Dendy (Pl. XXVIII. fig. 5; Pl. XXIX. fig. 6; Pl. XLVII. fig. 5).

1886. *Clathria Lendenfeldi*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 474.

Sponge (Pl. XXVIII. fig. 5) based upon a slender Gorgonia axis, which it encrusts. From the encrusting portion arise several straight, cylindrical, unbranched processes about 8 mm. in diameter, the longest of which is 94 mm. high. *Colour* in spirit light yellow. *Texture* soft, fibrous, elastic. *Surface* hispid, with a reticulate appearance due to the reticulate main skeleton (the specimen appears, however, to be a good deal worn). *Oscula* small and scattered.

Skeleton.—(*a*) *Dermal;* consisting of very slender, irregularly scattered, stylote spicules, often found in loose, irregular brushes. (*b*) *Main;* a reticulation of stout, well-developed horny fibre, cored in places (chiefly at the ends of the primary lines) by smooth stylote spicules. These spicules project freely from the ends of the primary fibres and thus give rise to the hispidation of the surface. The fibre (Pl. XLVII. fig. 5) abundantly is very echinated by spined stylote spicules, which are most abundant on the secondary fibres. The secondary fibres are, also, almost or entirely without an axial core of spicules.

Spicules.—(*a*) *Megasclera;* (1) long, straight, very slender, smooth styli or subtylostyli, very sharply and gradually pointed at the apex, sometimes faintly and minutely spined at the base, measuring about 0·35 by 0·005 mm.; dermal. (2) Much larger, stouter, smooth, very gradually and sharply pointed styli, slightly curved and measuring about 0·6 by 0·02 mm.; in the main skeleton. Much smaller styli also occur as constituents

[1] Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., 1884, p. 453.

of the main skeleton, the largest being generally found at the ends of the primary fibres. (3) Short, thick, straight, very bluntly pointed styli (Pl. XXIX. fig. 6), strongly spined all over, size about 0·08 by 0·005 mm.; echinating the skeleton fibre in great numbers. (*b*) *Microsclera;* of one kind only, viz., minute palmate isochelæ about 0·005 mm. long.

We have called this species after Dr. von Lendenfeld, who has a much fuller acquaintance with the sponge (viz., in its native haunts) than we have, although he has as yet published no description of it.

The strong development of the horny fibre, with the coincident reduction in the spicular element of the skeleton, and the form and great abundance of the echinating spicules, are good characters by which to recognize the species.

Locality.—Off Port Jackson. One specimen.

Clathria frondifera, Bowerbank, sp.

1875. *Halichondria frondifera*, Bowerbank, Proc. Zool. Soc. Lond., April 1875, p. 288.
1880. *Amphilectus frondifer*, Vosmaer, Notes from the Leyden Museum, vol. ii. p. 115.
1884. *Clathria frondifera*, Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., pp. 448, 612, pl. xlii. fig. j; pl. liii. fig. J.

This is a widely distributed and very common shallow-water species, and has been already described by two authors (Bowerbank and Ridley, *loc. cit.*), hence it is not necessary to enter into further details regarding it in this place.

Locality.—Station 188, September 10, 1874; lat. 9° 59′ S., long. 139° 42′ E.; west of Torres Strait; depth, 28 fathoms; bottom, green mud. One fine specimen.

Habitat.—Strait of Malacca; Gaspar Strait (Bowerbank); west of Torres Strait (Challenger); Thursday Island; Prince of Wales Channel, Torres Strait; Percy Island and Fitzroy Island, Queensland; Providence Reef and Island, Mascarene Group; Amirante Islands; Seychelle Islands (Ridley, "Alert").

Clathria elegantula, Ridley and Dendy (Pl. XXVIII. figs. 3, 3*a*; Pl. XXIX. figs. 14, 14*a*, 14*b*).

1886. *Clathria elegantula*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 474.

Sponge (Pl. XXVIII. fig. 3) sessile, the single specimen present consisting of several much flattened, expanded, divided lobes, based upon half of a dead bivalve shell. Height 81 mm., greatest breadth about the same. Thickness of lobes usually about 10 mm. The margins of the lobes are more or less deeply notched and slightly undulating. *Colour* in spirit pale, brownish-yellow. *Texture* soft and spongy, elastic and fibrous; internally rather cavernous. *Surface* very uneven, beset with numerous projecting conuli, between which is stretched the thin, semi-

transparent, parchment-like *dermal membrane*, covering the large subdermal cavities, and constituting a very characteristic feature of the species (Pl. XXVIII. fig. 3*a*). *Oscula* small and scattered (?) (there are a great number of round openings in the dermal membrane, especially on one side of the sponge, which might readily pass for oscula, but it is impossible to say how far they are due to shrinking back of the dermal membrane from the action of the spirit). *Pores;* on one side of the sponge are a number of small oval areas in which the dermal membrane is reduced to a sieve by numerous small perforations, which are the pores. The pore-areas are well defined and rather sparsely scattered; it is curious that they should occur on one side only, that being the side on which most of the oscula (?) are situated. Diameter of pore-areas and pores variable, of the former averaging about 0·5 mm. of the latter about 0·1 mm.

Skeleton.—In balsam preparations the arrangement of the skeleton somewhat resembles that of *Plumohalichondria*, the chief feature being a series of ascending, plumose columns, each consisting of a core of very slender, subtylostylote spicules echinated by entirely spined styli, the horny matter being almost invisible; but on examination in alcohol we see that there is a very large proportion of pale horny substance in the skeleton, which is arranged as follows:—There is a well-defined reticulation of horny fibre; branching primary fibres run upwards in wavy lines, ending at the surface of the sponge, and these alone are cored by long, slender, subtylostylote spicules. Secondary fibres cross the primary lines without much regularity, forming an anastomosing reticulation, and both series of fibres are echinated by spined styli. In the dermal membrane there are numerous subtylostylote spicules, scattered and in brushes.

Spicules.—(*a*) *Megasclera;* of two kinds. (1) Very slender, straight, smooth subtylostyli (Pl. XXIX. fig. 14), measuring about 0·2 by 0·003 mm.; (2) straight, slender, sharp pointed, entirely spined, echinating styli (Pl. XXIX. fig. 14*a*), measuring about 0·07 by 0·0032 mm. (*b*) *Microsclera;* of one kind only, viz., palmate isochelæ (Pl. XXIX. fig. 14*b*), of rather unusual form, with very slender shaft, rather strongly curved and making an unusually wide angle with the front palm; length about 0·02 mm.

This sponge is most readily recognised by its beautiful and characteristic external form.

Locality.—Station 162, April 2, 1874; lat. 39° 10′ 30″ S., long. 146° 37′ 0″ E.; off Moncœur Island, Bass Strait; depth, 38 fathoms; bottom, sand and shells. One fine specimen.

Clathria inanchorata, Ridley and Dendy (Pl. XXVIII. fig. 4; Pl. XXIX. figs. 13, 13*a*).

1886. *Clathria inanchorata*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 475.

Sponge (Pl. XXVIII. fig. 4) erect, slender, of very peculiar, rugged external appearance, the best idea of which will be obtained by reference to the figure. The

larger specimen is 200 mm. in height and has an average diameter of about 12 mm. *Colour* in spirit dull, yellowish-brown. *Texture* tough and fibrous. *Surface* extremely uneven and minutely hispid. *Oscula* numerous, small and scattered.

Skeleton.—There is a reticulation of very stout horny fibre, echinated by spined stylote spicules, and having the primary lines cored by smooth styli which may also project freely at the ends of the primary fibre. The secondary fibres appear to be without a spicular core.

Spicules.—(*a*) *Megasclera;* (1) smooth styli, very variable in size, measuring up to about 0·54 by 0·024 mm., but often much smaller. These spicules occur in the axis and projecting at the ends of the primary fibre; those at the ends are of large size. (2) Nearly or quite straight, sharply pointed, entirely spined styli (Pl. XXIX. fig. 13), echinating the skeleton fibre; size about 0·072 by 0·006 mm. (*b*) *Microsclera;* of one kind only, viz., smooth toxa (Pl. XXIX. fig. 13, *a*) measuring about 0·029 by 0·0016 mm.

The very characteristic external appearance and the fact that there is only one kind of microsclera present, and that a toxite, are, perhaps, the most characteristic features of this species, by which it may readily be recognized. Although it possesses no chetæ, yet this species agrees so closely with the genus *Clathria* in other respects that we have deemed it advisable to include it in that genus; it is, perhaps, a form that once possessed isochelate microsclera and has now lost them.

Locality.—Station 163A, April 4, 1874; lat. 36° 59′ S., long. 150° 20′ E.; Bass Strait; depth, 150 fathoms; bottom, green mud. Two specimens.

Genus *Rhaphidophlus*, Ehlers (Pls. XXVIII., XXIX., XLVI.).

1870. *Rhaphidophlus*, Ehlers, Die Esper'schen Spongien, Erlangen, pp. 19, 31.
1875. *Echinonema*, Carter, Ann. and Mag. Nat. Hist., ser. 4, vol. xvi. p. 185.

This genus differs from *Clathria* only in the possession of a distinct, dense crust of outwardly projecting spicules, the difference being one of degree rather than of kind.

The original diagnosis (*loc. cit.*, p. 31) runs as follows:—"Schwamm aus netzförmig vereinigten Balken mit dichter Rindenschicht aus stumpf-spitzen Nadeln, darunter im Gewebe ein Netz von Hornfasern, in welchen und um welche die gleichen Nadeln liegen, ausserdem eingepflanzte gedornte Nadeln, daneben gleichendige Doppelanker und mannigfach gebogene Kieselfäden."

This diagnosis is based upon a single species, *Rhaphidophlus cratitius*, Esper, sp., and is perhaps rather too restricted for generic use. The nature of the "Kieselfäden" is elucidated to some extent by the description of the species (*loc. cit.*, p. 19), which speaks of them as "sehr feine haarförmige Kieselfäden, welche ungleich lang und mannigfach gekrümmt sind: einfach spangenförmig, oder mit wieder aufgebogenen Enden, oder auch S-förmig, doch so, dass die Endtheile nicht in eine Ebene liegen."

Although the language is a little ambiguous there is no doubt that sigmata are here referred to.

Mr. Carter's genus "*Echinonema*" must be suppressed, as the species which it includes are not generically separable from the older genus "*Rhaphidophlus*," which Mr. Carter appears never to have recognised.[1] The genus "*Rhaphidophlus*" has a further claim to take precedence of "*Echinonema*" in that its founder gave a generic diagnosis thereof.

Rhaphidophlus gracilis, Ridley, sp.

1884. *Echinonema gracilis*, Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., p. 617, pl. liv. figs. 1, 1′, 1″.

One specimen of this species was obtained by the Challenger off Bahia. It agrees very minutely in external form and in spiculation with the type, but instead of being of a "very dark purplish-brown colour" (in spirit), it is greyish-yellow. It is very interesting to find this well-marked species occurring at two so widely separated localities as the Mascarene Islands and Bahia.

Locality.—Off Bahia; depth, 7 to 20 fathoms. One specimen.

Habitat.—Providence Reef, Mascarene Islands (Ridley, "Alert"); off Bahia (Challenger).

Rhaphidophlus filifer, Ridley and Dendy (Pl. XXVIII. fig. 2; Pl. XLVI. fig. 9).

1886. *Rhaphidophlus filifer*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 475.

Sponge (Pl. XXVIII. fig. 2) irregularly ramose; branches approximately cylindrical, but very uneven and with a gnarled appearance; the habit of the sponge appears to have been suberect or creeping. *Colour* in spirit greyish-yellow. *Length* of specimen 94 mm., average diameter of branches about 6 mm. *Texture* hard and almost incompressible. *Surface* very rugose and uneven, but with a slightly glabrous appearance.

Skeleton (Pl. XLVI. fig. 9).—(*a*) *Dermal;* consisting of a compact crust, about 0·14 mm. in thickness of densely packed, projecting brushes of stylote spicules with outwardly directed points. When viewed in surface section these tufts are seen to be arranged in a reticulate manner, so as to form approximately circular meshes about 0·1 mm. in diameter. (*b*) *Main;* a well-developed, but rather irregularly disposed reticulation of spiculo-fibre; one can in places roughly distinguish primary fibres, running towards the surface, from secondary fibres which cross them more or less at right angles and thus give rise to approximately rectangular meshes. The fibre itself is stout and well defined and is

[1] *Cf.* also Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., 1884, p. 615.

composed of smooth stylote spicules united together by a large proportion of horny matter; it is echinated by numerous smaller, spined styli, which project from the surface at right angles (Pl. XLVI. fig. 9).

Spicules.—(*a*) *Megasclera;* of three kinds—(1) nearly or quite straight, rather slender, sharply and gradually pointed styli, usually with slightly spined base; measuring about 0·2 by 0·0065 mm., forming the dermal crust. (2) Smooth, slightly curved, stout styli, measuring about 0·3 by 0·018 mm., forming the main skeleton. (3) Small, straight, entirely spined styli, measuring about 0·1 by 0·01 mm., echinating the skeleton fibre. (*b*) *Microsclera;* of two kinds. (1) Minute, palmate isochelæ, about 0·016 mm. long. (2) Very long, slender, hair-like toxa, usually occurring in very loose bundles, length about 0·16 mm. These are the most characteristic spicules of the species, and it is from their hair-like nature that the specific name has been taken. They may at once be recognised as toxa by the sharp bend in the centre.

From the same station as this sponge comes a species of *Pachychalina*, which so closely resembles the specimen of *Rhaphidophlus filifer* in external appearance as to be very readily mistaken for it (compare Pl. IV. fig. 1 with Pl. XXVIII. fig. 2). This close resemblance in external form between two such widely different species is very remarkable. The *Pachychalina* is a shade lighter in colour than the *Rhaphidophlus*.

This species resembles Mr. Carter's common Australian species *Echinonema typicum*,[1] the latter is, however, of a much more luxuriant growth, and the proportions of the spicules also differ. According to the original description there are no chelæ or toxa in *Echinonema typicum*, and only two forms of megasclera, but an examination of the dried types in the British Museum has given us good reason for asserting our belief in the presence of both forms of microsclera. We have not, however, found sufficient grounds for an identification. A redescription of *Echinonema typicum* from spirit specimens is much needed.

Locality.—Station 208, January 17, 1875; lat. 11° 37′ N., long. 123° 31′ E.; Philippine Islands; depth, 18 fathoms; bottom, blue mud. One specimen.

Rhaphidophlus lobatus, Vosmaer, sp., var. *horrida*,[2] nov. (Pl. XXVIII. fig. 1; Pl. XXIX. figs. 4, 4*a*, 4*b*, 4*c*).

1880. *Clathria lobata*, Vosmaer, Notes from the Leyden Museum, vol. ii. p. 151.

Sponge (Pl. XXVIII. fig. 1) stipitate, compressed, palmate, dichotomously branching. The stem, which is about 6 mm. in diameter, springs from a flattened and slightly expanded base and divides into two at a height of two inches from the ground, each branch again subdividing. Total height of specimen 106 mm.; breadth at the top (the broadest part) 44 mm. *Colour* in spirit light, greyish-yellow. *Texture* fine, fairly

[1] *Ann. and Mag. Nat. Hist.*, ser. 5, vol. vii. p. 378.

[2] So called from the bristling appearance of the surface when seen under a low power of the microscope.

firm and compact. *Surface* even, very minutely hispid. *Dermal membrane* thin and difficult to distinguish. *Pores* scattered (?). *Oscula* none observed; the sponge appears to be lipostomous.

Skeleton.—The main skeleton is a somewhat Isodictyal reticulation of stout stylote spicules; there is no very distinct fibre (although one can usually distinguish primary skeleton lines running towards the surface and crossed at right angles by secondary lines), but there is a fair amount of horny connecting substance at the nodes of the reticulation; the whole arrangement is rather vague and confused. In addition to the smooth stylote spicules, which form the chief portion of the main skeleton, there are numerous spined styli, some of which appear to echinate the main skeleton while others are scattered loosely through the soft tissues (some of the latter may have been forced from their proper position in cutting the sections; there can be little doubt that these spined spicules are really homologous with the echinating spicules of allied species). The primary fibres end on the surface in dense tufts of slender stylote spicules whose points project outwards; mingled with these are more of the echinating spined styli already mentioned, while the centre of each tuft is occupied by one or more large, smooth styli like those of the main skeleton.

Spicules.—(*a*) *Megasclera;* (1) Smooth, stout, usually slightly curved styli (Pl. XXIX. fig. 4), tapering gradually to a sharp point at the apex and narrowing towards the rounded base; size of full grown examples about 0·4 by 0·025 mm.; these form the main skeleton. (2) Much smaller, straight, slender styli or subtylostyli (Pl. XXIX. fig. 4*c*), rounded and usually very faintly spined at the base and tapering gradually to a sharp point at the apex, size about 0·23 by 0·0065 mm.; these form the tufts at the ends of the primary fibres. (3) Small, spined styli (Pl. XXIX. fig. 4*a*), almost or quite straight, very sharply pointed and with large, curved spines, shaped like the thorns on a briar. These spines are very unequally distributed, they are abundant at the base of the spicule, where they are arranged so as to point towards the apex, then they almost cease and at about the centre of the spicule become suddenly abundant again; in this second position they are very large, stout and curved so as to point towards the base; size of spicule about 0·175 by 0·013 mm; their arrangement has already been indicated. (*b*) *Microsclera;* of two kinds. (1) Very minute, palmate isochelæ, about 0·01 mm. long; abundant. (2) Toxa (Pl. XXIX. fig. 4*b*), with spined ends, size about 0·14 by 0·0024 mm., also abundant.

Vosmaer[1] briefly describes under the name *Clathria lobata* a new species from the Cape of Good Hope; this sponge certainly has a very remarkable resemblance to the Challenger species under discussion, but the description is so short and imperfect that an absolute identification would be impossible without comparison of specimens; till such is practicable we shall consider the Challenger sponge as a variety of Vosmaer's species,

[1] Notes from the Leyden Museum, vol. ii. p. 151, 1880.

being strengthened in this opinion by the fact that both came from the Cape of Good Hope.

The spiculation given by Vosmaer is as follows:—"Spic. tr. ac. f. (tr^0. ac. f.). tr. ac. sp. (strongly spined). ac^2. (rare). tr^2. Λ (sp.) ⌣. anc^2." He says also—"The sponge, which in the dried state is pure white, is rather elastic on account of the keratode-fibre. It forms more or less flat, branching lobes. Very characteristic for this species are the bows, the ends of which are spined . . . The anchors are small but rather stout, few in number. The spines of the tr. ac. sp. are very strong and bend towards the blunt end of the spicule. In the formula, I have designated with a ⌣ the small spicules which are often almost bent into a circle. I could not distinctly see whether the ends are blunt or pointed." We are pretty safe in eliminating the "ac^2. (rare)" either as foreign or abnormal, while the spicules designated with a ⌣ are almost certainly Diatom rings, which often occur abundantly as foreign bodies in sponge preparations; the presence of a tr^2. is perhaps a more serious difficulty; the large, smooth styli of the two sponges agree in being fusiform. It is the external appearance and the peculiar and very characteristic form of the spined styli and toxa in both sponges which induce us to put them in the same species, at any rate as a temporary arrangement. It is very unfortunate that Vosmaer has given no spicular measurements and no account of the arrangement of the skeleton; when these are known it will be much easier to arrive at a definite conclusion. The presence of the distinct tufts of slender stylote spicules at the ends of the primary fibres, forming a dermal crust, obliges us to place this species in the genus *Rhaphidophlus* rather than in the genus *Clathria*, though, as we have already had occasion to point out, the distinction is one of degree rather than of kind.

Locality.—Simon's Bay, Cape of Good Hope; depth, 10 to 20 fathoms. One specimen.

Genus *Plumohalichondria*, Carter (Pls. XXX., XLVII.).

1876. *Plumohalichondria*, Carter, Ann. and Mag. Nat. Hist., ser. 4, vol. xviii. p. 236.

The skeleton is arranged in plume-like columns (Pl. XLVII. fig. 4*a*). Megasclera oxea and styli; no special kind of dermal spicule. Microsclera isochelæ.

In his paper on the Classification of the Spongida[1] Mr. Carter founds a group of the "Ectyonida," under the name "Plumohalichondrina," in the following passage:—"Group 2. *Plumohalichondrina.* Here there are two forms of axial spicules, viz.—1, simple acuate, smooth or spined; 2, more or less pointed or inflated at the ends, which are often microspined scantily or sparsely. Echinating spicule club-shaped and spined. Flesh-spicule for the most part that termed by Dr. Bowerbank 'angulate equianchorate' (that is, with bow-shaped shaft and alæform arms), sometimes accompanied by a

[1] *Ann. and Mag. Nat. Hist.*, ser. 4, vol. xv. p. 144.

bihamate or C-shaped flesh-spicule, sometimes without any flesh-spicule at all. Forms massive, lobo-branched; branches compressed, dichotomous, separate or anastomotic, flabellate proliferous." On page 195 of the same volume the author gives "*Halichondria plumosa*, Johnst. (=*Hymeniacidon plumosa*, Bowerbank)" as an example of this group.

In vol. xviii of the same periodical (1876, p. 236) we first meet with the generic name "*Plumohalichondria*" in the description of the species named by Mr. Carter "*Plumohalichondria microcionides*"; but we find no generic diagnosis. Under these circumstances it has appeared to us advisable to retain the genus, which supplies a great want in the classification of the Monaxonida, and to give a generic diagnosis as above. Thus constituted, the genus appears to be fairly compact and well characterised; it includes a portion of Bowerbank's very heterogeneous genus "*Microciona*"[1] and certain other forms.

As examples of sponges which belong to the genus "*Plumohalichondria*," we may give *Plumohalichondria microcionides*, Carter, and *Plumohalichondria mammillata*, Carter.[2]

Plumohalichondria mammillata, Carter (Pl. XXX. figs. 4, 4*a*; Pl. XLVII. figs. 4, 4*a*).

1885. *Plumohalichondria mammillata*, Carter, Ann. and Mag. Nat. Hist., ser. 5, vol. xvi. p. 355.

Sponge (Pl. XXX. fig. 4) massive, with erect, compressed and rounded lobes. Height 94 mm., breadth 137 mm. *Colour* in spirit pale, yellowish-grey. *Texture* compact but soft and spongy. *Surface* glabrous but rather uneven and lumpy. *Dermal membrane* distinct, much strengthened by the presence of a very well-developed dermal reticulation of spicules. *Oscula* scattered; round openings, about 2 mm. in diameter, with their margins sometimes surrounded by a slight, projecting, membranous collar; sometimes flush with the general surface of the sponge, but usually sunk a little below the surface. *Pores* very numerous, thickly scattered, rounded openings; about 0·07 mm. in diameter.

Skeleton.—(*a*) *Dermal;* a very regular and definite reticulation (Pl. XLVII. fig. 4) of small, spined, stylote spicules; the meshes of the network are roundedly polygonal and only about 0·1 mm. in diameter, and each side is of about one spicule's length; the "fibre" (if we may be allowed to use a term which does not seem very applicable to the case in point) is composed of several spicules lying parallel side by side. (*b*) *Main;* composed of plumose columns of spiculo-fibre (Pl. XLVII. fig. 4*a*, *p.c.*) running towards

[1] Mon. Brit. Spong., vol. ii. p. 124.

[2] The genus *Plumohalichondria*, Carter, must not be confounded with the genus "*Aulospongus*," Norman, which was founded (*Ann. and Mag. Nat. Hist.*, ser. 5, vol. i. p. 267, footnote) for the reception of Bowerbank's "*Haliphysema tubulatum*," a remarkable sponge from Ceylon, which has some resemblance to *Plumohalichondria* but has no chelate nor oxeote spicules and is probably a very different thing.

the surface of the sponge; no secondary skeleton lines appear to be developed, but there are a very great number of loosely scattered megasclera. The fibres themselves are composed each of a central axis of smooth oxeote spicules very abundantly echinated by spined styli.

Spicules.—(*a*) *Megasclera;* (1) smooth, straight, somewhat fusiform, hastately pointed oxea, size about 0·2 by 0·005 mm. (2) Entirely spined, usually slightly curved, sharp pointed styli, which may attain a length of about 0·2 mm., but this is exceptional and they are usually much smaller, measuring about 0·1 by 0·005 mm. Although Carter (*loc. cit.*) describes two forms of spined stylote spicules, which he distinguishes according to their size, yet, as he himself states, both are echinating, and it appears to us probable that the smaller are simply young forms of the larger. (*b*) *Microsclera;* of one kind, viz., tridentate isochelæ, with moderately curved shaft, length up to about 0·02 mm.

This is a very fine and well characterised species, and as it is as yet very little known (although possibly common in Southern Australia), and as no figures of it are extant, we have thought it advisable to give a somewhat detailed description of it in this place.

Mr. Carter has very kindly sent us a small piece of his sponge for examination; we find from it that as regards the form and size of the spicules and the arrangement of the main skeleton, the Challenger sponge agrees sufficiently closely with that from Port Phillip Heads, but in the latter we have been able to discover no definite dermal reticulation such as we have described above, the dermal skeleton being an irregular reticulation of scattered oxeote and stylote spicules. It must, however, be borne in mind that we have only had a small piece to examine, and that this reticulation may possibly be present in other, and perhaps older, parts of the sponge, hence we have not thought fit to separate the two as distinct species.

Locality.—Station 162, April 2, 1874; lat. 39° 10′ 30″ S., long, 146° 37′ 0″ E.; Bass Strait; depth, 38 fathoms; bottom, sand and shells. One fine specimen.

Habitat.—Port Phillip Heads, Southern Australia (Carter); Bass Strait, (Challenger).

Genus *Plocamia*, Schmidt (Pls. XXIX., XXXI.).

1870. *Plocamia*, Schmidt, Spong. Atlant. Gebiet., p. 62.
1881. *Dirrhopalum*, Ridley, Journ. Linn. Soc. Lond. (Zool.), vol. xv. p. 476.

Sponge of varying form, may be encrusting or erect and branched. Spicules.—(*a*) Megasclera; dumb-bell-shaped or sausage-shaped (the characteristic spicules of the genus), and stylote. (*b*) Microsclera; isochelæ and (at any rate usually) toxa.

For details regarding the history and characters of this genus the reader is referred to Mr. S. O. Ridley's paper on the genus *Dirrhopalum* (*loc. cit., supra*).

The name "*Dirrhopalum*" was substituted for "*Plocamia*" on insufficient grounds, and must be abandoned in favour of the latter. The Challenger only obtained a single specimen of the genus, but this specimen is a very interesting one.

Plocamia coriacea, Bowerbank, sp., var. *elegans*, nov. (Pl. XXIX. fig. 9; Pl. XXXI. fig. 1).

1874. *Isodictya coriacea*, Bowerbank, Mon. Brit. Spong., vol. iii. p. 228, pl. lxxvi. figs. 7–12.
1881. *Dirrhopalum coriaceum*, Ridley, Journ. Linn. Soc. Lond. (Zool.), vol. xv. p. 481, pl. xxix. figs. 3–7.
1886. *Plocamia coriacea*, var., Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 475.

A single, small, dichotomously branched specimen (Pl. XXXI. fig. 1) of the form shown in the figure. Total height 38 mm.; diameter of branches, which are cylindrical, about 2·5 mm. *Colour* in spirit pale yellow. *Texture* soft and spongy. *Surface* even and minutely hispid. *Dermal membrane* very thin, delicateand transparent. *Oscula* and *pores* unknown; the sponge is apparently lipostomous.

Skeleton.—A close but irregular Isodictyal reticulation of the characteristic sausage-shaped spicules of the genus; amongst these, towards the surface, one distinguishes radiating lines of smooth stylote spicules, which terminate in free, projecting brushes, causing the hispidity of the surface.

Spicules.—(*a*) *Megasclera;* of three very distinct kinds. (1) (*a*) Fairly stout, slightly curved, smooth styli, with sharp points and evenly rounded bases (which are rarely or never spined, and differ from those of the type in this respect); above the base there is a slight constriction; these spicules vary much in size, averaging about 0·5 by 0·0126 mm.; they occur in the primary, radiating lines, from whose ends they freely project. (*β*) Very much slenderer, sharply pointed, straight subtylostyli, measuring about 0·3 by 0·003 mm., abundant in tufts on the surface, scattered through the dermal membrane, &c. (2) Curved, stout, entirely spined, sausage-shaped spicules (Pl. XXIX. fig. 9), with a slightly developed head at each end, which bears more numerous but perhaps smaller spines than the shaft; size about 0·11 by 0·0094 mm. This is the most abundant and characteristic spicule, it forms the Isodictyal reticulation above mentioned. (3) Entirely but slightly spined, slightly curved styli, narrowing towards the base, which bears more spines than the shaft; measuring about 0·18 by 0·0094 mm.; only fairly abundant, echinating the radiating, main fibres near the surface. (*b*) *Microsclera;* of two kinds. (1) Small, palmate isochelæ, length about 0·019 mm., very abundant in the dermal membrane, but not so common in the deeper parts of the sponge; (2) very numerous, slender toxa, with minutely spined ends, varying considerably in size, full grown examples being about 0·1 mm. long.

Bowerbank's species was, in the first instance, very imperfectly described, but it will be seen by reference to Ridley's description and figures (*loc. cit.*) that in the arrangement of the skeleton and the form and proportions of the various spicules the Challenger variety comes very near to it. The main difference in spicular measurements concerns the toxa, which seem to attain a greater size in Bowerbank's sponge than they do in ours.

The most striking difference, however, lies in the external form, and this is very remarkable, for the British specimen, instead of being of erect growth and definitely branched, is merely a small crust, and according to Bowerbank "does not exceed one and a half line in thickness" (*loc. cit.*, p. 229), while the colour in spirit (in the case of the Challenger specimen very pale) is stated to be very dark brown.

Locality.—Station 75, July 2, 1873; lat. 38° 38′ 0″ N., long. 28° 28′ 30″ W.; off the Azores; depth, 450 fathoms; bottom, volcanic mud. One specimen.

Genus *Acarnus*, Gray.

1867. *Acarnus*, Gray, Proc. Zool. Soc. Lond., p. 544.

Megasclera styli and tylota (? the latter may be absent), and echinating "Grapnel-spicules" (cladotylota), consisting each of a straight shaft with expanded base and a stellate projecting end with recurved teeth; these are the characteristic spicules of the genus. As microsclera there may be palmate isochelæ and toxa.[1]

Acarnus ternatus, Ridley.

1884. *Acarnus ternatus*, Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., p. 453, pl. xlii.figs. *b*, *b′*.

With this species we identify a single small specimen growing on a stone. It is in very bad condition and contains a great deal of foreign matter, but the characteristic ternate grapnel-spicules are abundant in it. The proportions of the spicules differ somewhat from those of the type, the main skeleton stylus being a good deal longer, but there are no sufficient grounds for separating the two forms specifically.

Locality.—Papiete Harbour, Tahiti; depth, 20 fathoms. One specimen.

Habitat.—Bombay? (Coll. Brit. Mus.); West Island and Prince of Wales Channel, Torres Strait; and Isle des Neufs, Amirante Islands (Ridley, "Alert"); Tahiti (Challenger).

Genus *Echinoclathria*, Carter (Pls. XXIX., XXXI.).

1884. *Echinoclathria*, Carter, Proc. Acad. Nat. Sci. Philad., 1884, p. 204.

External form various, sponge made up of a honeycomb-like mass of anastomosing, flattened trabeculæ. Skeleton reticulate, horny, with or without spicules in the fibre. Megasclera smooth, either styli or tylota; smooth echinating styli commonly present. Microsclera may be present in the form of palmate isochelæ.

Mr. Carter has given no diagnosis of the genus. Fortunately, however, in addition

[1] For further details concerning the genus, *vide* Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., 1884, p. 453.

to the descriptions published by him of several species, we have been able to refer to specimens in the British Museum named by Mr. Carter himself, and it is from these and from the good series brought home by the Challenger that the above diagnosis has been drawn up.

These remarkable honeycombed sponges appear to be very abundant off the south coast of Australia, and the question of their specific differences and their relations to other genera is a very difficult and intricate one. They are probably reduced Clathriids, in which, from the strong development of horny fibre rendering them unnecessary, the spicules are gradually disappearing, or, in other words, they are Clathriids on their way towards becoming horny sponges without spicules. Carter has described no forms with microsclera, but we have shown (see under *Echinoclathria favus* and *Echinoclathria carteri*) that palmate isochelæ, such as are found in typical *Clathriæ*, may be present. That the genus is closely allied to *Clathria* there can be no doubt, but it may be distinguished from the latter by the absence of a distinct kind of spined echinating stylus from the spicular complement; the fibre is, however, echinated by the smooth skeleton stylus or subtylostylus.

In accepting Mr. Carter's generic name, *Echinoclathria*, we hesitated before venturing to give a definite generic diagnosis. The present one must be regarded as preliminary. Before a satisfactory diagnosis becomes practicable a more extensive study of the group is required. The peculiar honeycombed external appearance is certainly very characteristic, but can hardly be regarded as absolutely distinctive; *Clathria frondifera*, Bowerbank, makes a near approach to it, and Carter includes in his genus *Echinoclathria* several forms which do not possess it.[1]

Echinoclathria favus, Carter (Pl. XXXI. figs. 4, 5, 5*a*).

1885. *Echinoclathria favus*, Carter, Ann. and Mag. Nat. Hist., ser. 5, vol. xvi. p. 292.

Sponge (Pl. XXXI. figs. 4, 5) massive or branched, lobate or digitate, commonly growing over the shells of living Pectens. Honeycombed throughout; consisting of a close reticulation of anastomosing and interwoven trabeculæ, with round or oval meshes between; the meshes on the surface may be either closed in marginally or Mæandriniform. Size very variable, the largest specimen is about 162 mm. high and 75 mm. broad. *Colour* in spirit greyish-yellow. *Texture* of trabeculæ tough, rather cartilaginous. *Surface* very minutely hispid. *Dermal membrane* thin, transparent, very rarely (Pl. XXXI. fig. 5*a*, *m*) stretching across the meshes at the surface of the sponge. *Oscula* (Pl. XXXI. fig. 5*a*, *o*) minute, scattered over the surfaces of the trabeculæ.

[1] Viz., *Echinoclathria tenuis*, *Echinoclathria nodosa*, *Echinoclathria subhispida*, *Echinoclathria gracilis* (*Ann. and Mag. Nat. Hist.*, ser. 5, vol. xvi. pp. 355, 356), but whether these really belong to the same genus as *Echinoclathria favus*, which is mentioned before any of them (*ibid.*, p. 292) is another question, into which we cannot here enter.

Skeleton.—A reticulation of well developed horny fibre, cored and echinated by subtylostylote spicules of one kind only.

Spicules.—(*a*) *Megasclera;* (1) smooth, fusiform subtylostyli, sharply pointed and constricted before the head, size about 0·1 by 0·0048 mm., in the fibre and echinating it and scattered. (2) Very long, thin, hair-like spicules, in which it is extremely difficult to make out the nature of the ends, (?) cylindrical, subtylostylote sometimes; length about 0·17 mm.; scattered. (*b*) *Microsclera;* at first we thought that this species was sharply marked off from *Echinoclathria carteri*, nobis, by the absence of microsclera, but since then we have seen a very few, faintly discernible, hair-like isochelæ, about 0·0126 mm. long, apparently on the verge of disappearance.

This species we have been enabled to identify through our examination of Mr. Carter's dried types in the British Museum.[1] His description (*loc. cit.*), seems to us to be misleading; it is possible that his account of the spiculation was taken from some other specimen than the two which we have examined (viz., his numbers 554 and 208 *bis*).

The species comes extremely close to our *Echinoclathria carteri*, but for the sake of convenience we separate them; they are distinguished by the fact that *Echinoclathria carteri* possesses abundant, distinct isochelæ,[2] and well-developed, long, slender subtylostylote spicules (scattered); the proportions of the spicules also differ in the two and the *typical* external forms of the two species are very distinct (*cf.* figs. 3, 4 and 5 on Pl. XXXI.). That the two species are connected by a series of intermediate forms there can be little doubt, but for the sake of convenience we at present keep them distinct.

The Challenger obtained six specimens of *Echinoclathria favus*, all of which are based upon Pecten shells; the inhabitants of the shells were evidently living when the sponges were dredged. This is a very interesting fact, for possibly we have here a case of commensalism. It is difficult to understand how a Pecten can swim about (in the manner stated of species of this genus by our conchological authorities) with a sponge of the size represented in Pl. XXXI. figs. 4, 5, attached to it, but the animal is still in the shell and in good condition; possibly the streams of water engendered by the sponge, bringing constant supplies of food, render motion on the part of the Pecten unnecessary.

Locality.—Station 162, April 2, 1874; lat. 39° 10′ 30″ S., long. 146° 37′ 0″ E.; off Moncœur Island, Bass Strait; depth, 38 fathoms; bottom, sand and shells. Six specimens.

[1] Mr. Carter, *loc. cit.*, says—"There are several specimens of it in the British Museum, mostly under four inches in their greatest diameter, of which Nos. 554 and 555, each registered 59. 10. 7. 106, may be mentioned as massive forms, and No. "208 *bis*" registered 37. 5. 13. 36. &c., as more or less digitate forms."

[2] Mr. Carter mentions no isochelæ in *Echinoclathria favus*, neither have we been able to find them in his dried types, but such delicate microsclera may be very readily overlooked in examining dried specimens.

Echinoclathria carteri, Ridley and Dendy (Pl. XXIX. figs. 12, 12*a*; Pl. XXXI. figs. 3, 3*a*).

1886. *Echinoclathria Carteri*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 476.

Sponge (Pl. XXXI. fig. 3) cylindrical, ramose, each branch consisting of flat, ribbon-like trabeculæ, anastomosing and interwoven so as to form a loose, honeycombed whole, with rounded meshes on the surface about 2 mm. in diameter. The largest specimen is about 250 mm. long; diameter of branches about 6 to 15 mm. *Colour* in spirit pale yellow. *Texture* (of the individual trabeculæ) tough and compact. *Surface* very minutely hispid. *Dermal membrane* thin, transparent, very rarely found stretching across the meshes on the surface. *Oscula* (Pl. XXXI. fig. 3*a*, *o*) minute, scattered over the trabeculæ.

Skeleton.—A rather close reticulation of strongly developed horny fibre, cored and echinated by stylote spicules of one kind only, though the spicules within the fibre seem to be usually slenderer than those outside.

Spicules.—(*a*) *Megasclera;* (1) smooth, sharply and gradually pointed styli (Pl. XXIX. fig. 12*a*), not markedly constricted above the base; measuring about 0·132 by 0·009 mm.; in the fibre, irregularly echinating the same, and scattered. (2) Long, smooth, very slender subtylostyli (Pl. XXIX. fig. 12), measuring about 0·16 by 0·002 mm.; irregularly scattered. (*b*) *Microsclera;* of one kind only, viz., small, palmate isochelæ, very abundant in some specimens, about 0·015 mm. long.

This is an exceedingly remarkable species. It might be thought that its peculiar external form would be quite sufficient to distinguish it from all other sponges, but there is a digitate variety of Carter's *Echinoclathria favus* (one of the types in the British Museum referred to by him,[1] and labelled 37. 5. 13. 36. and 208 *bis*), also from South Australia, which very closely resembles it. As regards external appearance the two may, however, be distinguished by the fact that in *Echinoclathria carteri*, nobis, the anastomosing trabeculæ usually present a flat surface towards the outside, while in *Echinoclathria favus*, Carter, they usually have their edges turned outwards. On examination with the microscope the two are more readily distinguished, for *Echinoclathria favus* possesses few or no chelæ, and there are also other slight differences in spiculation which will be seen by reference to the descriptions.

Localities.—Station 162, April 2, 1874; lat. 39° 10′ 30″ S., long. 146° 37′ 0″ E.; Bass Strait; depth, 38 fathoms; bottom, sand and shells. One or two specimens.

Station 163A, April 4, 1874; lat. 36° 59′ S., long. 150° 20′ E.; south-east Australia; depth, 120 fathoms; bottom, green mud. Three or four specimens.

Off Port Jackson; depth, 30 to 35 fathoms. One specimen.

[1] *Ann. and Mag. Nat. Hist.*, ser. 5, vol. xvi. p. 292.

Echinoclathria glabra, Ridley and Dendy (Pl. XXIX. figs. 11, 11*a*; Pl. XXXI. fig. 2).

1886. *Echinoclathria glabra*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii p. 476.

Sponge (Pl. XXXI. fig. 2) massive but honeycombed throughout, consisting throughout of thin, flattened trabeculæ, anastomosing and interwoven with one another, leaving oval or rounded meshes about 4 mm. in diameter. The single specimen in the collection is about 112 mm. high by 75 mm. broad, and 44 mm. thick; it has evidently been cut off at the base. *Colour* in spirit yellow. *Texture* firm and parchment-like. *Surface* (of the trabeculæ) glabrous. *Dermal membrane* thin, transparent, very rarely stretching across the mouths of the cavities at the surface. *Oscula* not observed, apparently the sponge is lipostomous.

Skeleton.—A reticulation of well-developed horny fibre, sparsely cored by tylota and sparsely echinated by smooth subtylostyli.

Spicules.—*Megasclera;* (1) smooth, fusiform subtylostyli (Pl. XXIX. fig. 11*a*), sharply and gradually pointed at the apex and constricted before the head, which is no wider than the shaft; size about 0·11 by 0·0063 mm.; echinating the horny fibre. (2) Long, smooth tylota (Pl. XXIX. fig. 11), very slender, with oval heads; measuring about 0·22 by 0·0032 mm., in the fibre and scattered, especially on the surface of the trabeculæ.

This species is distinguished by its glabrous surface and by the presence of the tylote spicules in the fibre and scattered. No microsclera are present. It is very probable that, owing to its spicular peculiarities, it ought to form the type of a new genus, but we prefer to leave the responsibility of this step to some one who has a larger series of forms for comparison than we have.

Locality.—Station 162, April 2, 1874; lat. 39° 10′ 30″ S., long. 146° 37′ 0″ E.; off Moncœur Island, Bass Strait; depth, 38 fathoms; bottom, sand and shells. One specimen.

Genus *Agelas*, Duchassaing and Michelotti (Pl. XXIX.).

1864. *Agelas*, Duch. and Mich., Naturkund. Verhand. Maatschapp. te Haarlem, ser. 2, vol. xxi. p. 76.
1867. *Ectyon*, Gray, Proc. Zool. Soc. Lond., p. 515.
1870. *Chalinopsis*, Schmidt, Spong. Atlant. Gebiet., p. 59.

Of various form; with well developed horny fibre echinated by verticillately spined stylote spicules. No microsclera and no other megasclera.

To Carter is due the merit of having pointed out[1] that *Ectyon sparsus*, Gray, is referable to the older genus *Agelas* of Duchassaing and Michelotti, nevertheless he retains Gray's generic name, *Ectyon;* in this we cannot, with due regard to the rules of priority,

[1] *Ann. and Mag. Nat. Hist.*, ser. 5, vol. ix. p. 281.

follow him, since, in spite of the extreme faultiness of the original descriptions, the genus is, according to Mr. Carter's own showing, recognisable. It is not known as a common type in any seas but those of the West Indies, whence Carter describes several species.

The systematic position of this genus is very doubtful. We include it here only on the supposition that it has lost its microsclera.

Agelas mauritianus, Carter sp. (Pl. XXIX. fig. 10).

1883. *Ectyon mauritianus*, Carter, Ann. and Mag. Nat. Hist., ser. 5, vol. xii. p. 310, pl. xii. fig. 3, *a*, *b*.

This species, so well characterised by its beautiful, moniliform, echinating spicule (Pl. XXIX. fig. 10), is represented in the collection by a single specimen of irregular massive form and curiously cavernous structure, but of doubtful locality; as the species has already been described, and the characteristic spicule figured by Mr. Carter (and now again by us), we need give no further details.

A parchment label inside the bottle bears the words, "Station 135 ? 60 fms."

Habitat.—Mauritius (Carter); off Tristan da Cunha (?) (Challenger).

Genus *Echinodictyum*, Ridley (Pl. XXXII.).

1881. *Echinodictyum*, Ridley, Journ. Linn. Soc. Lond. (Zool.), vol. xv. p. 493.

Skeleton reticulate. Megasclera smooth oxea in the fibre (sometimes accompanied by partially projecting, smooth, slender styli) and spined styli echinating the fibre. No microsclera.

The genus *Echinodictyum* was established by Ridley (*loc. cit.*) for certain species of various external habit, but agreeing in the possession of a reticulate skeleton consisting of smooth oxeote megasclera united together in fibres by spongin, the fibre being echinated by spined spicules projecting from it at right angles. Thus as regards spiculation it is distinguished from *Raspailia* only by virtue of its oxeote instead of stylote main megasclera; the external form is, however, usually massive and the skeleton reticulate and not radiate as is the case in *Raspailia*. Subsequently some species were found in which the fibre was accompanied by smooth slender styli sparingly associated with rather than inserted in it; the spicular distinction thus ceasing to be an entirely absolute one. It is probable, however, that the *Ectyonine* arrangement, the relations of the fibre and its spicules, and the bulky growth indicate that it forms a natural genus, distinct from *Raspailia* with its slender cylindrical axes, radiate skeleton arrangement, and almost exclusively stylote spicules. We include this genus amongst the Ectyoninæ, like the genus *Agelas*, on the supposition that it had at one time microsclera which it has now lost.

Echinodictyum rugosum, Ridley and Dendy (Pl. XXXII. figs. 1, 1*a*).

1886. *Echinodictyum rugosum*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 477.

Sponge (Pl. XXXII. fig. 1) stipitate, palmato-digitate, consisting of a short cylindrical stem about 19 mm. long, surmounted by a broad, flattened expansion which terminates in a series of flattened, digitate processes. Total height of specimen 187 mm., greatest breadth 131 mm.; thickness only about 4 mm. (the stalk is a little thicker). *Colour* in spirit greyish-yellow. *Texture* hard and rather brittle. *Surface* rugose, thickly beset with small, pointed eminences. *Oscula* and *pores* unknown.

Skeleton.—A well-developed, compact, but rather irregular reticulation of strong spiculo-fibre; the fibre consisting of a multispicular axis of smooth oxeote spicules, firmly united together, and very abundantly echinated by spined stylote spicules which project from it approximately at right angles.

Spicules.—*Megasclera*; of two kinds. (1) Smooth oxea, somewhat hastately pointed and usually bent at an angle in the centre, size about 0·3 by 0·015 mm., in the skeleton fibre. (2) Entirely spined styli (subtylostyli), tapering gradually to a fine but not very sharp point and with the spines most abundant on the base; size about 0·13 by 0·012 mm., abundantly echinating the skeleton fibre.

This species differs from all other described members of its genus in its palmate, slightly branched form; *Echinodictyum nervosum*, Ridley,[1] which also grows in one plane, being ramose from the stem upwards, and *Echinodictyum cancellatum*, Ridley,[2] forming a cancellate growth in a single plane.

Locality.—Station 190, September 12, 1874; lat. 8° 56′ S., long. 136° 5′ E.; south-west of New Guinea; depth, 49 fathoms; bottom, green mud. One specimen.

Echinodictyum asperum, Ridley and Dendy (Pl. XXXII. fig. 2).

1886. *Echinodictyum asperum*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 477.

Externally this species (Pl. XXXII. fig. 2) has very much the appearance of a so-called Keratose sponge. It is bushy and of suberect growth, cavernous and covered with large aculeations; most of the specimens are attached to fragments of coarse rock or Coral. Height commonly about 50 mm.; breadth about the same or a little more. *Colour* in spirit rich chocolate brown.[3] *Texture* coarsely fibrous. *Surface* uneven in the extreme, but glabrous where the dermal membrane is intact. *Dermal membrane* thin and transparent, containing an enormous quantity of reddish brown pigment granules disposed in small groups. This pigment is still more abundant in the deeper parts of the sponge.

[1] *Journ. Linn. Soc. Lond.* (Zool.), vol. xv. p. 496, pl. xxviii. figs. 7–10.
[2] Zool. Coll. H.M.S. "Alert," Brit. Mus., 1884, p. 457, pl. xl. fig. D.
[3] Evidently natural, as other sponges attached are not coloured like this.

Skeleton.—Composed of a very coarse, widely open reticulation of stout, tough spiculo-fibre, branching and anastomosing, and evidently containing a considerable quantity of horny cementing substance. This fibre is composed of longitudinally placed, very densely packed, slender oxeote spicules, firmly adherent to one another; and is echinated from the surface by spined stylote spicules which project at right angles to the fibre. The fibre itself is commonly about 0·5 mm. in thickness.

Spicules.—Megasclera; (1) smooth, slender, slightly curved, gradually and sharply pointed oxea, measuring about 0·35 by 0·0063 mm., forming by far the greater portion of the skeleton. (2) Straight, slender, tapering, bluntly pointed, entirely spined styli; spines small, abundant near the rounded apex, directed towards the base; size of spicule about 0·17 by 0·0075 mm.; echinating the skeleton fibre.

In its external form and in its wiry, bristle-like fibre this species differs very widely indeed from the foregoing, though in spiculation the two come very near to one another.

Locality.—Papieté Harbour, Tahiti; depth, 20 fathoms. Seven or eight specimens.

Family IV. Axinellidæ.

Skeleton typically non-reticulate; consisting of ascending axes of fibres from which arise subsidiary fibres radiating to the surface. Fibres typically plumose. Megasclera chiefly styli to which oxea and (or) strongyla may be added. Microsclera rarely present, never chelæ.

Genus *Hymeniacidon*, Bowerbank (Pls. XXXIII., XXXIX., XL., XLV.).

1864. *Hymeniacidon*, Bowerbank, Mon. Brit. Spong., vol. i. p. 191.

Form massive. Skeleton reticulate, composed of ill-defined spiculo-fibre, not plumose. Megasclera all monactinal, styli or subtylostyli. No microsclera.

Bowerbank's original diagnosis (*loc. cit.*) runs—"Skeleton without fibre, spicula without order, imbedded in irregularly disposed membranous structure." The genus certainly is a difficult one to diagnose but we must have something more definite than this to go by. Bowerbank's diagnosis includes far too much for any natural genus and its author makes no less than forty-two species of *Hymeniacidon* out of a total of one hundred and ninety-three species of British sponges.[1]

The original type of the genus is *Hymeniacidon caruncula*,[2] and, taking this as our starting point, we have endeavoured to construct a more compact genus with the diagnosis as given above.

The systematic position of the genus must still be regarded as very doubtful. Having

[1] Mon. Brit. Spong., vol. ii. p. xx.

[2] *Vide* Mon. Brit. Spong., vol. i. p. 191.

regard to its spiculation we have placed it amongst the Axinellidæ, although the arrangement of the skeleton is opposed to this view. Such a skeleton is, however, quite capable of giving rise by further development to a typical Axinellid skeleton, and it is possible, judging from its extreme simplicity, that *Hymeniacidon* represents the starting point from which the more typical Axinellidæ have branched off. Were it not for the form of the spicules, which are monactinal instead of diactinal, we should include the genus amongst the Renierinæ. It differs from most Axinellidæ in having the spicules of one form only and all of about the same size.

The genus is characteristically an inhabitant of shallow water.

Hymeniacidon caruncula, Bowerbank (Pl. XXXIII. fig. 3).

1864. *Hymeniacidon caruncula*, Bowerbank, Mon. Brit. Spong., vol. i. p. 191, pl. xxxv. fig. 372; vol. ii. p. 166; vol. iii. pl. xxxii. figs. 1–4; vol. iv. p. 81.
1867. *Reniera caruncula*, Gray, Proc. Zool. Soc. Lond., p. 518.
1870. *Amorphina caruncula*, Schmidt, Spong. Atlant. Gebiet., p. 76.

There are in the collection two specimens of this common British sponge from the Cape Verde Islands; both are rather small and with uneven (conulose) surface (Pl. XXXIII. fig. 3); the proportion of horny matter in the skeleton is very considerable. As the species is already sufficiently well known we do not propose to give any further description of it in this place.

Locality.—St. Vincent, Cape Verde Islands; shallow water. Two specimens.

Habitat.—British Isles[1] (Bowerbank); Cape Verde Islands (Challenger); Port Jackson (Ridley, "Alert").

Hymeniacidon sp.

We have to record from Station 313 a single, soft, massive specimen, in bad condition, which seems to be referable to this genus but is not sufficiently well characterised to merit a specific name. The surface, where preserved, is smooth, and the skeleton consists of very sparsely disposed columns of smooth stylote spicules united together by a considerable proportion of horny matter; the same spicules also occur loosely scattered.

Spicules.—Of one form only, viz., smooth, gradually sharp pointed styli, measuring about 0·43 to 0·5 by 0·0126 mm.

Locality.—Station 313, January 20, 1876; lat. 52° 20′ S., long. 67° 39′ W.; south-east of Patagonia; depth, 55 fathoms; bottom, sand; bottom temperature, 47°·8. One specimen.

[1] "One of the regular tide-mark sponges of our southern and western coasts," Norman (Mon. Brit. Spong., vol. iv. p. 81).

Hymeniacidon (?) hyalina, n. sp. (Pl. XLV. figs. 6, 6*a*, 6*b*).

Sponge massive, amorphous, encrusted by numerous foreign organisms; represented in the collection by two or three small, shapeless fragments, remarkable for their transparent, hyaline appearance; the largest one only about 19 mm. in diameter. *Colour* in spirit, very pale, yellowish grey, transparent. *Texture* soft and spongy, internally cavernous. *Surface*, for the most part encrusted by foreign organisms, where visible fairly smooth. *Dermal membrane* very distinct, hyaline. *Oscula* (? rather large and scattered).

Skeleton.—(*a*) *Dermal;* consisting of tylostylote spicules thickly and quite irregularly strewn through the dermal membrane. (*b*) *Main;* diffuse and irregular in the extreme, with only very slight indications of fibres running vertically towards the surface; composed of loosely and irregularly disposed tylostylote spicules of various sizes.

Spicules.—Megasclera; of one form only, viz., smooth, nearly straight tylostyli (Pl. XLV. figs. 6, 6*a*, 6*b*), with distinct but not very large, subglobular heads; sharply and fairly gradually pointed at the apex. Size very variable, but not differing in such a manner as to give rise to outside smaller and inside larger spicules as in the genus *Suberites;* the different sizes are throughout mixed up with one another; the maximum size is about 1·1 by 0·025 mm.

It seemed very doubtful whether it was worth while to describe a new species on such fragmentary evidence, but it is interesting to come across a form whose spiculation is almost exactly that of the genus *Suberites*, while the other characters, *e.g.*, the arrangement of the skeleton and the nature of the ectosome, are totally different. We doubtfully place the species in the genus *Hymeniacidon* because we do not know what else to do with it.

Locality.—Off the south-west coast of Patagonia. Two or three fragments.

Hymeniacidon (?) subacerata, Ridley and Dendy (Pl. XXXIX. fig. 4; Pl. XL. figs. 5, 5*a*).

1886. *Hymeniacidon (?) subacerata*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 478.

Sponge (Pl. XXXIX. fig. 4) massive; consisting of irregularly anastomosing trabeculæ, which may be subcylindrical, or angular, or more or less flattened and expanded. The largest specimen, taken as a whole, is about 88 mm. long by 62 mm. broad and 37 mm. thick. *Colour* in spirit pale yellow; the sponge is characterised also by a peculiar, waxy, translucent appearance. *Texture* rather brittle and cavernous. *Surface* glabrous in appearance, but rather harsh to the touch and very uneven. *Oscula* of fair size, mostly near the summit of the sponge, having their margins flush with the general surface.

Skeleton.—The main skeleton consists of a dense but quite irregular reticulation of large stylote spicules, the spicules occasionally lying side by side in loose tracts. At the surface there is a thin crust of similar large styli, also densely and very irregularly reticulate and giving support to numerous small stylote or subtylostylote spicules, which project more or less vertically outwards; we have never found these small projecting spicules forming a very dense crust, though in some parts they are very abundant; it is doubtful whether the layer of large styli on which they rest should be regarded as anything more than the uppermost part of the main skeleton.

Spicules.—Megasclera; (1) very large, stout, smooth, fusiform styli (Pl. XL. figs. 5, 5*a*), more or less curved or slightly crooked; tapering fairly gradually to a sharp point at the apex and tapering rather suddenly near the base to a very narrow neck; the base is evenly rounded off at the extremity, and is often so narrow that the spicule becomes nearly oxeote in appearance, but we have never found the base pointed, always rounded off; size about 1·2 by 0·031 mm. (2) Small, slender, nearly or quite straight, gradually and sharply pointed styli or subtylostyli; not markedly narrowing towards the base; size commonly about 0·2 by 0·0063 mm. The mode of occurrence of these two forms of spicules has been noted above.

This species would probably have been included by Mr. Carter in his genus *Leucophlœus*, but we are unable to discern any tangible and constant character whereby the latter genus may be separated from *Hymeniacidon*.

One of the most characteristic features of our present species is the shape of the large stylote spicule, which is very peculiar; it demonstrates that a stylus might readily give rise to an oxeote spicule. The narrowing towards the base of the spicule may also be seen, though not carried to the same extent, in *Leucophlœus fenestratus*, Ridley,[1] especially in one of the varieties. The small surface spicule appears to occur in *Leucophlœus fenestratus* also (though not described), but is much stouter there. In *Leucophlœus proteus*,[2] Ridley, it appears not to occur, and the large spicule has an ordinary broad, rounded base. The external form of *Hymeniacidon* (?) *subacerata* is quite different from that of *Leucophlœus fenestratus*.

Locality.—Station 208, January 17, 1875; lat. 11° 37′ N., long. 123° 31′ E.; Philippine Islands; depth, 18 fathoms; bottom, blue mud. Three specimens.

Genus *Phakellia*, Bowerbank (Pls. XXXIV., XXXV., XXXVI., XL.).

1864. *Phakellia*, Bowerbank, Mon. Brit. Spong., vol. i. p. 186, &c.

Sponge more or less flabellate or cup-shaped. Skeleton often more or less reticulate. Megasclera styli and often oxea. No microsclera.

[1] Zool. Coll. H.M.S. "Alert," Brit. Mus., 1884, p. 464, pl. xlii. fig. *s*.
[2] *Op. cit.*, p. 620, pl. liii. fig. B; pl. liv. fig. *k*.

Bowerbank's original diagnosis is, as usual, based entirely on the arrangement of the skeleton. It is unnecessary to quote it at length (*vide loc. cit.*). The type of the genus is *Phakellia ventilabrum*, Johnston, sp.

We have thought it desirable in this case to make use of external form as a generic character, otherwise we know of no character which would serve to separate the genus *Phakellia* from the genus *Axinella*.

Phakellia ventilabrum, Johnston, sp., var. *connexiva*, nov. (Pl. XXXV. figs. 3, 3*a*).

1842. *Halichondria ventilabrum*, Johnston, British Sponges, p. 107.[1]
1864. *Phakellia ventilabrum*, Bowerbank, Mon. Brit. Spong., vol. i. p. 186; vol. ii. p. 122, vol. iii. pl. xxii. figs. 1–7.
1866. *Phakellia robusta*, Bowerbank, Mon. Brit. Spong., vol. ii. p. 120; vol. iii. p. 54. pl. xxi. figs. 13–17.

There are from Station 122 a number of fine, frondose specimens which we propose to consider as a variety of the above species. In external form they are distinguished from the types of the species by their greater size, altogether more robust growth and strong venation. The specimens are in the form of broad, flattened, erect lamellæ (Pl. XXXV. fig. 3), reaching as much as 200 mm. in height, with very strong, projecting veins caused by the presence of stout bands of spiculo-fibre ramifying and anastomosing from the base upwards. The surface is strongly hispid and in spirit the specimens are of a brownish-yellow colour, in part due to the presence of a considerable amount of sand adhering to them.

The spiculation consists of smooth styli and stout "vermicular" spicules, the former measuring about 1·5 to 1·8 by 0·034 to 0·04 mm., and the latter about 0·65 to 0·72 by 0·035 mm. In spiculation the species *Phakellia ventilabrum* is practically identical with *Axinella erecta*, but is separated from the latter by the very different external form; we also agree with Schmidt[2] in considering Bowerbank's *Phakellia robusta* merely as a variety of *Phakellia ventilabrum*.[3]

Localities.—Station 122c, September 10, 1873; lat. 9° 10′ S., long. 34° 49′ W.; east of Brazil; depth, 400 fathoms; bottom, red mud. A number of large pieces.

Station 317, February 8, 1876; lat. 48° 37′ S., long. 55° 17′ W.; north-east of the Falkland Islands; depth, 1035 fathoms; bottom, hard ground (gravel); bottom temperature, 35°·7. One piece of much more delicate appearance than the foregoing; almost white, and translucent, a condition which is, however, largely due to maceration, probably owing to the time occupied in raising the specimen from such a depth.

Habitat.—British seas (Bowerbank, Johnston, &c.); Ireland (Johnston); Shetlands (Bowerbank); between Scotland and Faröe Islands (Carter); south-west coast of

[1] See also Johnston, *loc. cit.*, for list of synonyms previous to his time.
[2] Spong. Atlant. Gebiet., p. 62.
[3] Details as to the minute anatomy of *Phakellia ventilabrum*, var. *connexiva*, will be found in the Introduction.

Norway (Schmidt); Arctic Ocean, off Norway (Vosmaer); Baltic Sea (Fristedt); ? Gulf of St. Lawrence (Whiteaves); Florida, Gulf of Mexico and Barbados (Schmidt); off Brazil and north-east of Falkland Islands (Challenger).

The species is typically an inhabitant of deep water, being common in depths over 100 fathoms, seldom occurring in shallower water, and going down to 1035 fathoms, as shown by the Challenger dredgings.

Phakellia flabellata, Ridley and Dendy (Pl. XXXIV. figs. 2, 3, 3*a*; Pl. XL. figs. 6, 6*a*).

1886. *Phakellia flabellata*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 478.

Sponge (Pl. XXXIV. figs. 2, 3) erect, stipitate; stem rather short, stoutish, cylindrical, ending below in a widish, flattened base of attachment, and expanding rather suddenly above into a broad, flattened, vertical lamella with undulating margin. One side of the lamella is thrown into more or less pronounced, rather irregular, longitudinal furrows and ridges, while the other is comparatively smooth and bears numerous stellately disposed oscula (Pl. XXXIV. fig. 3*a*). The finest specimen in the collection is 125 mm. in total height and the same in breadth; the stem is 25 mm. long and 8·5 mm. in greatest diameter (being not quite round). The lamelliform portion is only about 3 mm. thick (except along the prominent ridges). *Colour* in spirit greyish-yellow. *Texture* rather soft and brittle. *Dermal membrane* thin and transparent. *Pores* very abundant on the surface which bears no oscula, in small groups over the ends of narrow inhalent canals, where they reduce the dermal membrane to a mere network; the pores themselves are round or oval openings about 0·07 to 0·1 mm. in diameter; on the opposite side of the sponge they are scarce or absent. *Oscula* (Pl. XXXIV. fig. 3*a*) numerous, on one side only of the sponge, in round, stellate groups of eight or ten; the oscula themselves are minute, round and about 0·5 mm. in diameter; the groups are fairly regularly placed at about equal distances, and are about 4 mm. (or a little less) in diameter.

Skeleton.—From the point where the stem enters the sponge stout, branching bands of spiculo-fibre, containing a very large proportion of dark-coloured, horny cementing material, radiate upwards through the soft tissues. In addition to this fibrous skeleton there is a rather irregular, somewhat Halichondrioid reticulation of stout stylote spicules, terminating at the surface in divergent brushes of much smaller, slender styli. Each brush surrounds the apex of one of the larger styli, and the apices of its own spicules project for a short distance beyond the surface of the sponge.

Spicules.—Megasclera; (1) stout, smooth, slightly curved, sharply and rather abruptly pointed styli (Pl. XL. fig. 6); measuring about 0·5 by 0·03 mm.; forming the main skeleton, occurring both in the fibre and in the reticulation outside of it. (2) Much smaller, straight, smooth, slender styli (or subtylostyli) (Pl. XL. fig. 6*a*), sharply and

rather abruptly (hastately) pointed, measuring about 0·22 by 0·0063 mm., occurring in the surface brushes.

This is a very pretty and well-characterised species, which may be readily recognised by its external form and more especially by the arrangement of the oscula. From the number obtained by the Challenger it would seem to be abundant near Port Jackson.

Judging from the description and from a preparation of that species, it would appear to resemble *Spongia caliciformis*, Lamarck, most nearly of described forms, but that species, as yet only known from the North Sea, is cup-shaped.

Locality.—Port Jackson; depth, 30 to 35 fathoms. Eleven specimens.

Phakellia papyracea, Ridley and Dendy (Pl. XXXVI. fig. 4).

1886. *Phakellia papyracea*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 478.

Sponge (Pl. XXXVI. fig. 4) very thin, lamelliform. Represented in the collection by fragments only, possibly cup-shaped when alive; perforated all over by very numerous, minute, round (? oscular) openings. Alike on both surfaces. Thickness of lamellæ about 2 mm. *Colour* in spirit yellow or brown. *Texture* fragile. *Surface* fairly even, very minutely hispid. *Oscula* (?) very abundant on both surfaces, minute.

Skeleton.—Reticulate, rather vague and indefinite; distinct fibres present but very loose, composed of large stylote spicules, with spicules of a smaller size scattered between, or also in loose fibres. There is no special dermal skeleton, but the small stylote spicules are very much more abundant at the surface than elsewhere, especially around the oscular (?) openings.

Spicules.—Megasclera; of two kinds; (1) large, stout, smooth styli, rarely subtylostylote, usually more or less curved and fairly gradually sharp-pointed, size about 0·7 by 0·02 mm. (2) Much smaller and slenderer styli or subtylostyli, commonly rather crooked; sharply and fairly gradually pointed; size variable, say about 0·35 by 0·0063 mm. but often much smaller.

This is a very delicate species, which perhaps comes near to Bowerbank's *Isodictya infundibuliformis*,[1] more especially if it should ultimately prove to be cup-shaped when perfect, but it is distinguished at once and absolutely from that species by the absence of the oxeote spicules, so that further comparisons are needless. In the absence of the oxeote spicules, however, it agrees with von Marenzeller's *Cribrochalina ambigua*,[2] but differs widely in the size of the spicules, which, in *Cribrochalina ambigua* "sind Stifte von 0·23 bis 0·34 mm. Länge," while there do not seem to be two distinct sizes as in our sponge.

Localities.—Station 145A, December 27, 1873; lat. 46° 41′ S., long. 38° 10′ E.; off

[1] Mon. Brit. Spong., vol. ii. p. 317; vol. iii. pl. liv., &c.

[2] Poriferen, Anthozoën, Ctenophoren und Würmer, von Jan Mayen; Vienna, 1886, p. 1, pl. i. fig. 1.

Prince Edward Island; depth, 310 fathoms; bottom, volcanic sand. Fairly abundant fragments, of a brown colour.

Station 148, January 3, 1874; lat. 46° 47′ S., long. 51° 37′ E.; Possession Island; depth, 210 fathoms; bottom, hard ground, gravel, shells. Two or three small, yellow pieces.

Genus *Ciocalypta*, Bowerbank (Pls. XXXIII., XL.).

1864. *Ciocalypta*, Bowerbank, Mon. Brit. Spong., vol. i. p. 179.

Megasclera stylote and sometimes oxeote, forming a more or less dense central skeleton (fibrous or reticulate) from which are given off pillars of spiculo-fibre nearly at right angles. These spread out at their distal ends and support the dermal membrane, with its reticulation of spiculo-fibre, at some distance from the central portion of the sponge, thus leaving huge subdermal spaces into which the water enters through the pores in the dermal membrane. No microsclera.

Bowerbank's original diagnosis (*loc. cit.*) runs as follows:—"Skeleton. Composed of numerous closed columns, each consisting of a central axis of compact, irregularly elongated, reticulated structure, from the surface of which radiate, at about right angles, numerous short simple, cylindrical pedicles, or stout fasciculi of closely packed spicula; the distal ends of each pedestal separating and radiating in numerous curved lines which spread over the inner surface of the dermal membrane, separating and sustaining it at all parts at a considerable distance from the central axis of the skeleton."

In this diagnosis there is not a word as to the form of the spicules. The original type of the genus is *Ciocalypta penicillus*, Bowerbank, in which the spicules are all stylote. In *Ciocalypta tyleri*,[1] Bowerbank, the spicules are all oxeote, but it seems very doubtful whether this species is referable to the genus *Ciocalypta* at all.

Bowerbank's *Ciocalypta leei*,[2] represented by a single, minute, dry specimen, about 13 mm. in length and only about 3 mm. in greatest diameter, must be regarded as a young specimen of *Ciocalypta penicillus*, or at the most as a mere variety, and the same remark applies to the specimen which has been called by Mr. Carter *Ciocalypta tuberculata* (*vide* p. 175). There are thus (excluding the doubtful *Ciocalypta tyleri*) three species of the genus now known, viz., *Ciocalypta penicillus*, Bowerbank, *Ciocalypta hyaloderma*, nobis, and *Ciocalypta amorphosa*, nobis; for *Ciocalypta calva*,[3] Ridley, is wanting in one of the chief characters of the genus, viz., the characteristic arrangement of the dermal skeleton; and it also possesses a horny fibre.

The genus differs from *Axinella* most markedly in the possession of a distinct, spiculo-fibrous dermal reticulation, and further in the very large size of the subdermal cavities.

[1] *Proc. Zool. Soc. Lond.*, 1873, p. 21, pl. iv. figs. 9–12.
[2] Mon. Brit. Spong., vol. iii. p. 296, pl. lxxxvi. figs. 1–4.
[3] Zool. Coll. H.M.S. "Alert," *Proc. Zool. Soc. Lond.*, 1881, p. 115, pl. x. fig. 7.

Ciocalypta hyaloderma, Ridley and Dendy (Pl. XXXIII. figs. 2, 2*a*).

1886. *Ciocalypta hyaloderma*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 479.

Sponge (Pl. XXXIII. fig. 2) cylindrical, or subcylindrical; ramose. The largest piece in the collection consists of a very short, stout, basal portion (evidently broken off below), from which two short branches diverge at a very wide angle; distance from apex of one branch to that of the other 40 mm.; diameter of branches from about 8 to 13 mm. A second fragment is cylindrical, measuring 44 mm. in length by 10 mm. in diameter; it gives off a single branch near the middle, of which the stump only remains. *Colour* in spirit dirty brown. *Texture* very delicate and fragile. *Surface* fairly even. *Dermal membrane* (Pl. XXXIII. fig. 2*a*) very delicate, absolutely transparent; supported at some distance from the underlying tissues (which can be distinctly seen through it) on slender pillars; marked with numerous little white stars, caused by the spicules which compose the supporting pillars radiating as they abut against it and forming the principal nodes in a well-developed dermal reticulation of spiculo-fibre. *Oscula* (Pl. XXXIII. fig. 2*a*) scattered over the branches, of fair size, each surrounded by a prominent membranous collar; about 2 mm. in diameter. *Pores*, round openings in the dermal membrane, about 0·05 mm. in diameter; rather difficult to make out on account of the extreme transparency of the dermal membrane even when examined in spirit.

Skeleton.—Consisting, in the solid central portion, of a loose reticulation of bands of spiculo-fibre and detached spicules, with a very marked preponderance of longitudinal fibres. Short pillars of spiculo-fibre, as already stated, connect the central portion of the sponge with the dermal membrane; the spicules at the distal ends of these pillars expand into divergent brushes which form each a "node" in the dermal reticulation. The dermal reticulation is very well developed and very wide meshed, consisting of usually stout bands of spiculo-fibre, radiating, roughly speaking, from the distal ends of the supporting pillars, and branching and anastomosing with one another.

Spicules.—Megasclera; of one form only; viz., smooth, usually slightly curved, fairly gradually but not very sharply pointed styli, commonly narrowing slightly towards the base; these are variable in size, in the dermal reticulation they commonly measure about 0·53 by 0·014 mm., while in the central portion of the sponge they measure about 1·0 by 0·037 mm.

This species certainly comes very near to the original type of the genus, viz., *Ciocalypta penicillus*, Bowerbank; but is distinguished by its different growth and much more delicate structure throughout; the central axis is not so dense as in that species, and the dermal reticulation is not so confused and has much wider meshes.[1] The spicules also attain a considerably larger size than in *Ciocalypta penicillus*.

[1] In this respect Bowerbank's *Ciocalypta leei*, which is no doubt a very young specimen of *Ciocalypta penicillus*, resembles the present species.

There is in the British Museum a single dried specimen[1] which in its delicate appearance comes nearer to the present species, but still ought probably to be regarded as a variety of *Ciocalypta penicillus;* indeed a careful examination of the types has convinced us that it is so. Mr. Carter[2] refers to it as follows :—"In the British Museum, among the specimens dredged up on board the 'Norna' on the coast of Portugal, is a sponge of a similar conical form, also grouped, but with a tuberculated surface, each tubercle of which is supported on a bundle of spicules that radiate from a solid, conical, central axis. Here, however, there is only one kind of spicule, viz., acuate, smooth, and sharp pointed; so that it does not belong to the Ectyonida, but, belonging to the Axinellida, might be called '*Ciocalypta* (Bk.) *tuberculata*,' seeing that, like other species of this group about to be mentioned, it will probably have to come under the order Echinonemata." The tuberculated appearance here noticed is caused merely by the sinking in of the dermal membrane between the supporting columns on drying, and is quite as prominent a feature in the dried specimens of *Ciocalypta penicillus.*

Locality.—Station 320, February 14, 1876; lat 37° 17′ S., long. 53° 52′ W.; off the mouth of the Rio de la Plata; depth, 600 fathoms; bottom, green sand; bottom temperature, 37°·2. Four pieces.

Ciocalypta amorphosa, Ridley and Dendy (Pl. XL. fig. 9).

1886. *Ciocalypta amorphosa*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 479.

Sponge massive, amorphous; forming shapeless, rounded masses, the largest of which is about 75 mm. long by 50 mm. broad and 38 mm. thick. *Colour* in spirit grey. *Texture* very spongy, fibrous, honeycombed; resembling that of a common bath sponge which has been prepared for use, but not nearly so tough. *Surface*, in the present condition of the sponge extremely rough and shaggy, beset with numerous fibrous tufts which, in the perfect condition, support a very delicate dermal membrane continuously stretched over them at some little distance from the main mass of the sponge. *Dermal membrane* very thin, delicate and transparent; only portions of it remain, supported on the outspread ends of the fibrous tufts above mentioned. *Oscula* (?). *Pores* extremely numerous, round or oval openings, scattered through the dermal membrane, variable in size.

Skeleton.—The main skeleton is a very loose, confused, vaguely fibrous reticulation of very long oxeote and stylote spicules; this skeletal arrangement obtains in the trabeculæ of tissue between the numerous wide canals of the sponge. At the surface are given off from the main mass loosely fibrous columns of spicules which spread out at their distal

[1] Registered 72.5.4.1.

[2] *Ann. and Mag. Nat. Hist.*, ser. 4, vol. xviii. p. 235.

extremities and give support to the dermal membrane. The dermal membrane is strengthened by a very irregular "dermal reticulation" composed of loose spiculo-fibre.

Spicules.—*Megasclera* (Pl. XL. fig. 9); (1) very long, slender, slightly curved, fusiform oxea; sharply and rather suddenly pointed; size variable, up to about 1·7 by 0·02 mm. (2) Large, usually slightly curved styli, with evenly rounded base; shorter and stouter than the oxea; size variable, up to about 1·47 by 0·028 mm. The styli are plentiful, but not so common as the oxea; occasionally also a stout strongylote spicule is seen, evenly rounded off at each end; these are, at any rate commonly, shorter than either oxea or styli. The full-grown spicule appears to gain in thickness what it loses in length, and this is probably the case in many species, as held by Carter.[1]

Unfortunately all the specimens of this sponge, which seems to be abundant at Station 320, are much frayed out and injured. It is an interesting species which might easily be mistaken for a Renierine, but the variety in form of the spicules and the arrangement of the skeleton show its Axinellid relationships. It is at once distinguished both from *Ciocalypta penicillus*, Bowerbank, and *Ciocalypta hyaloderma*, nobis, by its external form and also by its spiculation. The manner in which the dermal membrane is supported at a distance from the body of the sponge, on the outspread ends of columns of spiculo-fibre, necessitates the reference of this species to the genus *Ciocalypta*.

Locality.—Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; off the mouth of the Rio de la Plata; bottom, green sand; bottom temperature, 37°·2. Five or six specimens.

Genus *Acanthella*, Schmidt (Pl. XXXII.).

1862. *Acanthella*, Schmidt, Spongien d. Adriat. Meeres, p. 64.
1870. (?) *Pandaros*, Duchassaing de Fonbressin and Michelotti, Spong. Mer Caraïbe, p. 88.

Axinellidæ of ramose, bushy, or frondose external form; of cartilaginous consistency, and with glabrous surface beset with ridges and spines; there is no distinct horny fibre; smooth linear megasclera (*e.g.*, styli, strongyla and unequal-ended oxea) are present. No microsclera.

Schmidt's diagnosis runs "Halichondriæ ramosæ et fruticosæ, tanquam spinis obsitæ. Cutis lævis, porosissima, quæ in ramis crassioribus sola pigmento infecta est et veræ pellis instar a parenchymate distinguitur. Parenchyma spisse impletum spiculis simplicibus longioribus, substantia firmiori non inclusis."

The genus appears to us to be a good one, although queried by Vosmaer,[2] and sufficiently distinct from other genera of Axinellidæ to deserve separation; the original type is *Acanthella acuta*, Schmidt.

The cartilaginous consistency is a marked characteristic of the genus, and is evidently due to the peculiar character of the mesoderm.

[1] *Ann. and Mag. Nat. Hist.*, ser. 5, vol. iii. p. 284.
[2] Bronn's Klass. u. Ordn. d. Thierreichs, Porifera, p. 344.

The spiculation is distinguished by its plasticity, the different forms of linear spicules appearing to run into each other, and to have little constancy within the genus; species are, however, separable by the forms and proportions of their spicules. An elongated flexuous form is fairly constant.

Acanthella pulcherrima, Ridley and Dendy (Pl. XXXII. fig. 3).

1884. *Acanthella* sp., Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., 1884, p. 463.
1886. *Acanthella pulcherrima*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 479.

This species was obtained by the "Alert" and described by Ridley (*loc. cit.*) without a name and with no figures. We have decided to quote the original description and to add a figure of the very characteristic external form (Pl. XXXII. fig. 3).

"Externally resembling *Spongia carduus*, Lamarck (Ann. Mus. Hist. Nat. xx. p. 381). When guided by the description alone, I had referred the present specimen to this species with more confidence than usual; but on mounting sections of the probable type specimen at Paris, I saw that it was a different species. The points in which the description does not quite suit this form are "pédicule cylindracé, très-dur," the stem having apparently been flattish, and, though stiff, not inflexible; and "couleur d'un blanc grisâtre," whereas this (in spirit) is flesh-colour. The ridges run longitudinally up and down the sponge, and are 1 to 3 millims. high, and their free edge is beset with sharp (in spirit flexible) points at intervals of one or two millimetres. Texture tough and flexible, substance compact, surface between inequalities glabrous. It is a true *Acanthella*. The spiculation is as follows:—(1) Smooth acuate, slightly curved, tapering gradually to a sharp point, about ·4 to ·6 millim. by ·0095 millim. (2) Smooth undulating cylindrical with rounded ends, length about ·7 millim., diameter just ·0063 millim.

"The species differs from the Adriatic forms, *A. acuta* and *obtusa*, Schmidt, in the broad explanate form and in the smaller size of the spicules, the cylindrical being much shorter and thinner, the acuate much shorter than in those species. The skeleton forms a loose-fibred *Axinella*-like network of spicules, imbedded in a dense, transparent, almost colourless mass of caoutchouc-like consistency, containing nucleoid bodies about ·007 to ·008 millim. in diameter.

"*Hab.* Prince of Wales Channel, Torres Straits, 7 fms. A single specimen in spirit, 35 millim. ($1\frac{2}{5}$ inch) high by 29 millim. across."

As regards spiculation we must further add that an unequal-ended oxeote spicule is also common, of about the same size as the stylus. This is a remarkably pretty sponge. The Challenger obtained one specimen (Pl. XXXII. fig. 3), measuring about 56 mm. in height and 46 mm. in breadth; it is based upon an agglomeration of Polyzoa, fragments of barnacles, &c., and is a very much finer example than that obtained by the "Alert."

Locality.—Cape York, Torres Strait; depth, 3 to 11 fathoms.

Habitat.—Torres Strait ("Alert," Challenger).

Acanthella (*?*) *stipitata*, Carter, var. n.

1881. *Acanthella stipitata*, Carter, Ann. and Mag. Nat. Hist., ser. 5, vol. vii. p. 380, pl. xviii. fig. 8.

This sponge is represented in the collection by a slight variety from Torres Strait. It differs from the type of the species as described by Mr. Carter (*loc. cit.*)—(1) in having the stem obsolete and represented only by a constricted base; (2) in having the stylote megasclera larger, measuring about 0·5 by 0·009 mm. as against 0·347 by 0·009 mm. (25 by $\frac{2}{3}$ — 1800th inch, as given by Mr. Carter). In addition to the large stylus there is in the Challenger specimen a long, very slender spicule which is extremely abundant and often flexuous, and is very likely a young form of the other. Mr. Carter further remarks that the styli in his sponge are "abruptly sharp-pointed;" we cannot say this of our specimen, in which the styli are very gradually sharp-pointed. Mr. Carter's figure of the spicule, however, does not confirm his description.

In habit this variety closely approaches *Clathria frondifera*, which is abundant at the same locality.

We are by no means certain that the species is correctly placed in the genus *Acanthella*; it seems to us to have close affinities with *Echinoclathria*, Carter.

Locality.—Station 186, September 8, 1874; lat. 10° 30′ S., long. 142° 18′ E.; off Cape York, Torres Strait; depth, 8 fathoms; bottom, Coral mud. One specimen.

Habitat.—Bass Strait (Carter); Torres Strait (Challenger).

Genus *Axinella*, Schmidt (Pls. XXV., XXXIII., XXXIV., XXXV., XXXVI., XXXVII., XXXVIII., XL.).

1862. *Axinella*, Schmidt, Die Spongien des Adriat. Meeres, p. 60.

Sponge typically ramose, but may be massive. Skeleton fibre plumose. Megasclera stylote and sometimes oxeote. No microsclera.

This is a very critical genus, and it is impossible to give a satisfactory diagnosis of it. It comes very near to *Raspailia*, but the latter is conveniently kept distinct on account of its very characteristic, whip-like external form.

Axinella arborescens, Ridley and Dendy (Pl. XXXV. figs. 4, 4*a*).

1886. *Axinella arborescens*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 479.

Sponge (Pl. XXXV. fig. 4) erect, branched, stem and branches cylindrical or sometimes more or less flattened. Branches often forming anastomoses. Total height of sponge 212 mm.; length of stem up to first branch 50 mm., diameter of same 15 mm.; diameter of branches about 8 mm. *Colour* in spirit greyish-yellow. *Texture* firm

but rather woolly. *Surface* even and fairly smooth where intact. *Dermal membrane* thin and transparent, mostly abraded. *Oscula* minute, arranged along the branches in small groups, which often have radiating cracks proceeding from them, and thus acquire a stellate appearance. *Pores* scattered.

Skeleton.—Fibre not very distinct; several main fibres run up the centre of each branch, not very distinct from one another, forming a kind of ill-defined central axis from which primary fibres radiate at more or less acute angles towards the surface, where they terminate in dense brushes of stylote spicules. The fibre itself, though not very well defined, is clearly arranged on the Axinellid plan, *i.e.*, it consists of stylote spicules whose bases lie together in the centre of the fibre while their apices project outwards and upwards at acute angles. The primary fibres are everywhere linked together by individual spicules, which commonly lie at right angles to them in the horizontal plane. In the centre of the branch there seems to be a fair development of horny cementing substance.

Spicules.—Megasclera; these are, almost exclusively, short, stout, slightly curved, rather abruptly pointed styli, very constant in size, measuring about 0·28 by 0·024 mm. Occasionally also one meets with a strongylote spicule of about the same size, but these are of rare occurrence and should probably be regarded merely as abnormal forms of the styli.

This is a fine, showy species, with a very characteristic external form.

The spiculation is characterised by its simplicity, and by the unusual constancy in size of the styli; the arrangement of the skeleton, however, in columns radiating from a loose central axis, seems to mark the true position of the species as a member of the genus *Axinella*.

Locality.—Port Jackson; depth, 30 to 35 fathoms. One specimen.

Axinella balfourensis, Ridley and Dendy (Pl. XXXIII. fig. 1).

1886. *Axinella balfourensis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 480.

Sponge (Pl. XXXIII. fig. 1) erect, stipitate, consisting of a spreading, much branched root surmounted by a long, cylindrical stem, which at a height of 112 mm. above the root divides into two branches, each branch again dichotomising; altogether giving rise to a large head of long, thick, dichotomously branching, finger-like processes, the different branches often anastomosing with one another, and terminating in tapering points. Total height of specimen (including root) 350 mm.; diameter of stem a little over 6 mm. Diameter of finger-like processes in head 8 mm. or a little more. *Colour* in spirit yellowish-grey. *Texture* of stem firm and compact; of finger-like processes in head exceedingly soft and spongy, fragile. *Surface* very slightly hispid, fairly smooth. *Dermal*

membrane thin and very delicate. *Oscula* rather small, scattered up and down the soft, finger-like processes. *Pores* (? thickly scattered over the finger-like processes).

Skeleton.—Loose separate bands of spiculo-fibre run up the centre of each branch and form an ill-defined axis, from which radiate other loose, thin fibres towards the surface, crossed irregularly and sparingly by separate spicules. At the surface are numerous loose, radiating brushes of stylote spicules, whose points project slightly beyond the dermal membrane. The same arrangement holds good, with very slight modification, in the stem.

Spicules.—Megasclera; very slender, smooth, straight or very slightly curved styli, sharply and gradually pointed at the apex; size about 0·42 by 0·0075 mm.; of the same shape both in the dermal tufts and in the main skeleton, but in the former of only about half the size. The entire skeleton seems singularly insufficient for the requirements of so large a sponge, and, as a consequence, the sponge is very flexible, soft and fragile.

This seems to be a very aberrant species of the genus, as indicated both by its external form and by the extreme sparseness of the skeleton.

Locality.—Balfour Bay, Kerguelen; depth, 20 to 60 fathoms. One specimen.

Axinella mariana, Ridley and Dendy (Pl. XXXIV. fig. 1; Pl. XL. fig. 2).

1886. *Axinella mariana*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 480.

Sponge (Pl. XXXIV. fig. 1) of delicate growth, erect, proliferously branched; stem short, rather slender; branches rather slender, somewhat flattened. Total height 52 mm., breadth about the same. Length of stem 13 mm., diameter 3 mm. *Colour* in spirit greyish-yellow. *Texture* very soft and friable externally, internally pretty tough. *Surface* of branches echinated by abundant, very long, projecting spicules.

Skeleton.—In the centre of each branch there is a fairly dense core of irregularly arranged, short, bent, stylote spicules. In this confused mass are imbedded the bases of very large, stout styli, whose apices project far beyond the surface of the sponge.

Spicules.—Megasclera; of two kinds—(1) short, smooth (rarely slightly spined) styli or subtylostyli, each with a single sharp bend near the base (Pl. XL. fig. 2, *b*), finely and gradually pointed at the apex; size about 0·3 by 0·013 mm. (but variable). (2) Very long, smooth styli or tylostyli (Pl. XL. fig. 2, *a*), usually with a slight bend towards the base, very gradually and finely pointed at the apex; size about 2·2 by 0·03 mm.; echinating the surface of the sponge and with their own bases echinated by the smaller styli.

This is a pretty little species, distinguished by its external form and by the peculiar shape of the smaller stylote spicule, which seems to be homologous with the "vermicular" spicule of *Axinella erecta*, &c.

Locality.—Off Marion Island; depth, 50 to 75 fathoms. One specimen.

Axinella profunda, Ridley and Dendy (Pl. XXXVIII. figs. 2, 3; Pl. XL. figs. 3, 3*a*).

1886. *Axinella profunda*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 480.

Sponge (Pl. XXXVIII. fig. 2) small, erect, stipitate, dichotomously branched; stem and branches slightly flattened in one and the same plane; stem expanding below into a small, woody base. Height of specimen 50 mm.; breadth of stem and branches about 4 mm. *Colour* in spirit yellowish-grey. *Texture;* there is a tough, woody axis surrounded by a soft, spongy coat. Thin, membranous threads extend and form connections between adjacent branches; possibly we have here the first steps on the road to complete anastomosis such as not infrequently occurs between adjacent branches of ramose sponges. *Surface* fairly even where the dermal membrane is intact, hispid. *Dermal membrane* thin and transparent. *Oscula* of moderate size, scattered.

Skeleton.—There is a dense central axis of more or less longitudinally placed, large stylote spicules, from which similar spicules radiate to the surface in tracts or brushes, projecting beyond it and surrounded by bunches of smaller, slender styli whose apices also project beyond the surface.

Spicules.—Megasclera; of one form only, viz., styli (Pl. XL. figs. 3, 3*a*), straight, or nearly so, and sharply pointed; ranging in size from about 0·55 by 0·0084 to about 2·0 by 0·037 mm.; the bases of the spicules, with few exceptions, are very minutely spined (Pl. XL. fig. 3*a*).

This description is taken from one specimen only (that from Station 241). A second (Pl. XXXVIII. fig. 3), met with since it was written, confirms it in a very satisfactory manner indeed, even down to the spination of the bases of the styli; but it is of a dark, reddish-brown colour.

The most characteristic feature of the species is, perhaps, the incipient spination of the bases of the stylote spicules; this, though very minute, is a perfectly definite feature; it is most noticeable in the smaller spicules. The species is especially interesting on account of the very great depth and the widely distant localities from which it was obtained. It would appear to be a widely spread species in abyssal regions of the Pacific, maintaining its peculiar specific characters with singular constancy in very different localities.

Localities.—Station 241, June 23, 1875; lat. 35° 41′ N., long. 157° 42′ E.; North Pacific Ocean; depth, 2300 fathoms; bottom, red clay; bottom temperature, 35°·1. One specimen.

Station 281, October 6, 1875; lat. 22° 21′ S., long. 150° 17′ W.; South Pacific Ocean; depth, 2385 fathoms; bottom, red clay; bottom temperature, 34°·9. One specimen.

Axinella erecta, Carter, sp. (Pl. XXXV. figs. 1, 2, 2*a*, 2*b*, 2*c*; Pl. XXXVI. fig. 2; Pl. XL. figs. 1, 1*a*).

1866. (?) *Hymeraphia vermiculata*, Bk. (? *pars*), Mon. Brit. Spong., vol. i. pl. i. fig. 5; vol. ii. p. 141; vol. iii. pl. xxvi. figs. 1–3.

1867. (?) *Bubaris vermiculata*, Gray, Proc. Zool. Soc. Lond., p. 522.

1876. *Hymeraphia vermiculata*, var. *erecta*, Carter (*pars*), Ann. and Mag. Nat. Hist., ser. 4, vol. xviii. p. 307, pl. xii. fig. 4; pl. xv. fig. 26, *a*, *b*.

This very variable species is represented in the collection by a large number of specimens from divers localities.

The specimens from Inaccessible Island (Pl. XXXVI. fig. 2) are by far the finest; erect and massively ramose or subramose, the largest being 100 mm. in height and up to 41 mm. in breadth; their spicules are a good deal smaller than those of the smaller specimens from other localities (Pl. XXXV. figs. 2, 2*a*, 2*b*, 2*c*), but the size of the spicules is extremely variable in the same sponge and seems also to vary a good deal in different individuals of this species. All the specimens belong to Mr. Carter's var. *erecta* (*loc. cit.*, *supra*), which we here consider as the type of the species. The long stylote spicule (Pl. XL. fig. 1) measures up to nearly 3 mm. in length, with a breadth of about 0·037 mm.; while the "vermicular" (strongylote) spicule (Pl. XL. fig. 1*a*) measures about 0·21 by 0·037 mm. (these measurements are taken from one of the small specimens from Station 148A); the "vermicular" spicule is here considerably larger than in Mr. Carter's types, which approach more nearly in spiculation to our specimens from Inaccessible Island.

The specimens described by Bowerbank under the name *Hymeraphia vermiculata* are mere patches of sponge, which might perhaps be young forms of other species as well as of *Axinella erecta*.

Schmidt's *Axinella mastophora*[1] approaches very near to this species; it is, however, distinguished by its external form (which may not, perhaps, count for much), consisting of a number of erect, smooth lobes, and by the fact that the large stylote spicule is very constantly constricted towards the base. *Axinella rugosa*, Schmidt,[2] also comes very near to this species in its spiculation and in the possession of a surface covered with rounded rugosities, but is distinguished by the presence of very numerous, minute, angulated oxea.

Localities.—Station 145A, December 27, 1873; lat. 46° 41′ S., long. 38° 10′ E.; off Marion Island; depth, 310 fathoms; bottom, volcanic sand. One specimen, of *Clathria*-like external appearance, subfrondose and of a deep brown colour.

Station 147, December 30, 1873; lat. 46° 16′ S., long. 48° 27′ E.; west of Crozet Island; depth, 1600 fathoms; bottom, Diatom ooze; bottom temperature, 34°·2. Two specimens.

Station 148A, January 3, 1874; lat. 46° 53′ S., long. 51° 52′ E.; off Crozet Island; depth, 550 fathoms; bottom, hard ground, gravel, shells. Twenty-six specimens.

Inaccessible Island, October 1873; depth, 90 fathoms. Four specimens.

[1] Spong. Atlant. Gebiet., p. 61, pl. iv. fig. 14. [2] *Loc. cit.*

Off Tristan da Cunha, October 18, 1873 ; depth, 100 fathoms. One specimen.

Off Nightingale Island, Tristan da Cunha; depth, 100 to 150 fathoms. Two specimens, and also a third, which, though it differs rather strikingly in external form from the rest, we have decided to include in this species pending further discoveries. The specimen in question is erect, clathrous, and proliferously branched ; the branches are very short and compressed (Pl. XXXV. fig. 1).

Habitat.—? British Isles (Bowerbank); Atlantic Ocean, between the North of Scotland, the Shetland and the Faröe Islands (Carter); South Atlantic and Southern Ocean (Challenger).

Axinella echidnæa, Ridley, var. n. (Pl. XXXVI. fig. 3).

1813. (?) *Spongia echidnæa*, Lamarck, Ann. Mus. Hist. Nat., vol. xx. p. 448.
1884. *Axinella echidnæa*, Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., p. 462, pl. xliii. fig. *a*.

There occurs in the collection a single specimen (Pl. XXXVI. fig. 3), from off Bahia, which we propose to consider as a variety of the above-mentioned species. The various points in which it deviates from the type of the species may be briefly enumerated as follows:—(1) *External appearance;* the type specimens have, for the most part, a broadly flabellate form, while the Challenger specimen, consisting, however, of only a single branch, is (like one of the types) cylindrical, and its surface is beset with numerous irregular prominences; these prominences are much larger, broader and further apart than in the type. (2) *Spiculation;* the spicules are, as in the type, smooth oxea and styli, the former being much more abundant than the latter. In the present variety the oxeote spicule measures about 0·5 by 0·022 mm. and the stylus about the same. For the type, however, the spiculation is given as follows:—"(1) Smooth, slightly curved acerate, tapering gradually to sharp points, or more or less blunted at one or both ends; size ·3 by ·0095 to ·44 by ·0127 millim.: these forms compose the main bulk of the skeleton. (2) Long smooth acuate, generally slightly curved, tapering gradually to a fine point; size about 1·1 by ·0127 millim.: forming part of longitudinal skeleton-lines of surface-tufts." Styli (acuates) as long as those here mentioned appear, however, to be very rare in the type, and considering the well-known irregularity of the Axinellid spiculation in general we feel quite justified in not separating the two forms specifically.

Locality.—Off Bahia, shallow water. One specimen.

Habitat.—Torres Strait ("Alert"); off Bahia (Challenger).

Axinella fibrosa, Ridley and Dendy (Pl. XXXVII. fig. 3).

1886. *Axinella fibrosa*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 481.

Sponge (Pl. XXXVII. fig. 3) erect, massive, dividing into many lobes at the summit. Height of specimen 162 mm.; breadth 87 mm. *Colour* in spirit greyish-yellow.

Texture soft and spongy, coarsely fibrous; the fibres becoming readily denuded of the soft tissues so as to project freely beyond the surface. *Surface*, where intact, subglabrous but conulose, with a minutely reticulate appearance. *Dermal membrane* peeling off fairly easily from the underlying tissues, not supported by any special skeleton, hence readily tearing. *Oscula* small and scattered. *Pores* scattered through the dermal membrane.

Skeleton.—There is no dermal skeleton, but the main skeleton is very strongly developed. It consists of a system of stout fibres, branching and occasionally anastomosing, and coming to the surface in tufts. The fibre itself is very characteristic, consisting in the first place of a core of stylote spicules whose bases are, as a rule, in the centre, and whose apices project more or less outwards and forwards; being thus arranged in a fairly typical Axinellid manner. This spicular core is almost completely ensheathed in spongin, beyond which the apices of only a few spicules project. At the surface each branch of the fibre ends in a small, brush-like expansion. The average diameter of the fibre is about 0·4 mm.; it is, of course, slenderer at the surface than in the deeper parts of the sponge.

Spicules.—Megasclera; of one form only, viz., smooth styli, slightly bent towards the base and usually very gradually and sharply pointed at the apex; size about 0·63 by 0·015 mm.

This species is peculiarly interesting on account of the unusually strong development of spongin in the skeleton-fibre. It affords an additional good instance of the remarkable fact that horny fibre may be developed in any group of sponges and is hence of very little importance for purposes of classification. The massive form and the putty-like appearance of the surface between the fibres are further points distinguishing the species from its allies.

Locality.—Station 313, January 20, 1876; lat. 52° 20′ S., long. 67° 39′ W.; east of Strait of Magellan; depth, 55 fathoms; bottom, sand; bottom temperature, 47°·8. One specimen.

Axinella reticulata, Ridley and Dendy (Pl. XXXVII. figs. 4, 4*a*).

1886. *Axinella reticulata*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 481.

Sponge (Pl. XXXVII. fig. 4) massive, sessile, with somewhat constricted base below, and several short, thick-walled oscular tubes above. Height 38 mm.; greatest breadth 44 mm.; breadth at base 29 mm. *Colour* in spirit very pale yellow. *Texture* firm, almost incompressible. *Surface* very uneven, beset with numerous small conuli which extend over the oscular tubes, but glabrous. *Dermal membrane* distinct, minutely reticulate (Pl. XXXVII. fig. 4*a*), but almost or quite without spicules. *Pores* in the meshes of the dermal network; several in each mesh, reducing it to a secondary network. *Oscula*, one at the summit of each oscular tube, about 4 mm. in diameter.

Skeleton.—There is an extremely irregular reticulation of scattered spicules, amongst which one can distinguish rather loose, plumose fibres, running more or less vertically towards the surface.

Spicules.—Megasclera; (1) rather short and stout, smooth, slightly curved styli; usually with a bend towards the base; sharply and fairly gradually pointed at the apex; size about 0·45 by 0·02 mm. (2) Smooth, curved oxea, sharply and fairly gradually pointed; of about the same size as the styli; scarce.

The most characteristic feature of this sponge is the glabrous, reticulate dermal membrane; the reticulate appearance is not caused by the presence of a reticulate dermal skeleton but by a network of thicker, faintly fibrous-looking tissue in the dermal membrane itself.

The species is further distinguished within its genus by its large, prominent oscula.

Locality.—Bahia; depth, 7 to 20 fathoms. One specimen.

Axinella monticularis, Ridley and Dendy (Pl. XXXVIII. fig. 5).

1886. *Axinella monticularis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 481.

Sponge (Pl. XXXVIII. fig. 5) massive, subglobular, sessile, but apparently free. The largest specimen measures 44 by 31 by 21 mm. *Colour* in spirit yellowish-grey. *Texture* firm and compact, very gritty owing to the presence of a large quantity of calcareous foreign matter (*e.g.*, Foraminifera) within the sponge. Some of the foreign bodies are large and others small, but all become completely enveloped by the sponge. *Surface* thickly covered with very numerous, sharp, prominent but small conuli, averaging about 1·5 mm. in height, which give to the specimens a very characteristic appearance. Over and between the conuli the surface is glabrous, yet it is in parts very minutely hispid.

Skeleton.—There is no dermal reticulation. The numerous foreign bodies in the sponge are echinated by the spicules and many of them also form an origin for stout columns of typical Axinellid spiculo-fibre. The skeleton columns are well developed and run vertically to the surface, ending in the conuli above mentioned. They are composed of stylote spicules of various sizes, some smooth and some (of the smaller ones) spined; the spicules have their bases towards the centre of the fibre and their apices projecting freely outwards and forwards in a plume-like fashion. Normally all the spicules appear to have some definite base, either in the fibre, where each one is supported by the rest, or on some foreign body; but a few may be observed loosely scattered between the fibres.

Spicules.—Megasclera; styli, of two distinct kinds. (1) Smooth, usually slightly bent towards the base, very gradually and sharply pointed (tapering from base to apex);

size about 0·6 by 0·0126 mm. (2) Smaller, entirely spined styli (usually subtylostylote), commonly a little bent towards the base and gradually sharp pointed; length commonly about 0·1 mm. but may reach up to 0·25 mm., thickness about 0·0066 mm.

This is probably a common shallow-water species in the Cape Verde Islands. It is remarkable on account of the high development of the Axinellid fibre and of the numerous foreign bodies which the sponge contains. The latter character is probably due to the nature of the bottom on which it lives. It is further distinguished by the presence of the entirely spined styli.

Localities.—St. Vincent, Cape Verde Islands; shallow water. Three specimens.

Harbour, St. Vincent, July 1873; depth, 7 to 20 fathoms. One specimen.

Axinella (*?*) *lunæcharta*,[1] Ridley and Dendy (Pl. XXXVII. figs. 1, 1*a*, 2).

1886. *Axinella* (*?*) *lunæcharta*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 481.

Sponge (Pl. XXXVII. figs. 1, 2) massive, sessile, subglobular. Size of largest specimen about 38 by 31 by 25 mm., with a deep concavity on the lower surface. A second specimen is about 21 mm. in diameter and attached to a small pebble. *Colour* in spirit very pale yellow. *Texture* fairly firm, but compressible and rather spongy. *Surface* uneven but glabrous, with numerous small, monticular eminences, amongst which occur fewer but much larger eminences, volcano-like, each with a distinct crateriform depression at the top, which is about 2·5 mm. in diameter. (The degree of development of these crateriform eminences differs in different specimens.) *Pores* (*?*). *Oscula* minute, in the crateriform depressions (Pl. XXXVII. fig. 1*a*).

Skeleton.—There is no special dermal skeleton; the main skeleton is loosely reticulate, consisting of primary lines of loose spiculo-fibre running vertically to the surface and crossed by still looser and vaguer secondaries composed for the most part of single spicules. The spicules in the main fibres are all, or nearly all, directed towards the surface of the sponge, but the Axinellid character of the fibre is barely recognisable.

Spicules.—Megasclera; (1) smooth styli, more or less bent towards the base and very gradually and sharply pointed; size about 0·4 by 0·014 mm. (2) Smooth oxea, usually gradually sharp pointed at both ends, but very commonly with one end larger and less sharply pointed than the other; size about 0·35 by 0·0126 mm. It is very common in Axinellid sponges to find *a few* oxea along with the styli, but in this species the oxea are abundant, though not so much so as the styli. The not uncommon tendency which they exhibit towards blunting at one end seems to indicate that one form may be derived from the other.

[1] So called from the resemblance which the surface of the sponge bears to a map of the moon, owing to the numerous crateriform eminences.

The species may be readily recognised by its very characteristic external appearance.
Localities.—St. Vincent, Cape Verde Islands; shallow water. Two specimens.
Harbour, St. Vincent, July 1873; depth, 7 to 30 fathoms. One specimen.

Axinella (?) *tubulosa*, Ridley and Dendy (Pl. XXXVIII. fig. 4).

1886. *Axinella* (?) *tubulosa*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 482.

Sponge (Pl. XXXVIII. fig. 4) erect, tubular; tubes either open at the top or closed, finger-like, the latter probably young forms of the former. There is only one small specimen in the collection, consisting of one broad, tubular process, 17 mm. wide, and widely open at the summit, and one narrow, closed, digitate tube 6 to 8 mm. wide; both arising from a common basal portion. Height of specimen 50 mm. *Colour* in spirit greyish-yellow. *Texture* fairly firm. *Surface* uneven, pitted and rather corrugated. *Oscula* small, numerous on the inner surface of the wide, open tube.

Skeleton.—Extremely vague and confused, with no distinct fibre, consisting of a loose, irregular reticulation of large, stout, stylote spicules, with small slender styli in loose brushes near the surface and also scattered about. Around the mouth of the wide tube is a narrow, delicate, membranous collar, supported solely by the slender stylote spicules.

Spicules.—*Megasclera;* smooth styli. (1) Large and stout, more or less bent, fairly gradually sharp pointed; size about 0·87 by 0·03 mm., thickest in the centre. (2) Similar but much shorter and slenderer styli, size about 0·45 by 0·009 mm.

The most interesting feature about this species is its tubular form; a character, which, so far as is known to us, is hitherto unparalleled amongst the Axinellidæ, except in Schmidt's "*Auletta sycinularia*;"[1] that sponge is, however, regularly ramose instead of merely lobose, like the present species.

Locality.—Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; off the Rio de la Plata; depth, 600 fathoms; bottom, green sand; bottom temperature, 37°·2. One specimen.

Axinella (?) *paradoxa*, Ridley and Dendy (Pl. XXV. fig. 4).

1886. *Axinella* (?) *paradoxa*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 482.

Sponge (Pl. XXV. fig. 4) sessile, massively lobate; height of single specimen present about 25 mm. *Colour* in spirit pale, greyish-yellow. *Texture* india-rubber-like, with a firm, gelatinous ectosome; internally fibrous. *Surface* glabrous, but conulose. The conuli are projections caused by the vertically ascending skeleton columns; hence they occur chiefly on the summits of the lobes, while the sides are rather ridged or grooved.

[1] Spong. Atlant. Gebiet., p. 45, pl. iv. fig. 5. This sponge is evidently an Axinellid, as is shown by Schmidt's figures of the spicules.

Oscula small but very evident, in groups on the tops of the lobes; diameter of each about 1·5 mm.

Skeleton.—There is no dermal skeleton present. The main skeleton is composed of large oxeote spicules which, for the most part, form very stout but very loose *Axinella*-like fibres. The fibres all run more or less vertically upwards, but radiate somewhat from the centre of the base. Numerous spicules also occur irregularly scattered between the fibres, so that the whole skeleton becomes confused.

Spicules.—Megasclera; of one kind only; viz., large, smooth oxea, almost always gradually and finely pointed at both ends, and slightly curved; size about 0·87 by 0·022 mm.

The systematic position of this sponge is very difficult to determine. The form of the spicules would seem to indicate that it belongs to the Renierinæ, but the arrangement of the skeleton places it amongst the Axinellidæ. Probably it belongs rather to the latter group than to the former, and has simply lost the styli which form the most important part of the skeleton in most Axinellids (*cf. Axinella* (*?*) *lunæcharta*, p. 186).

The peculiar gelatinous or india-rubber-like ectosome marks it off from most hitherto known species of either group, though it is more nearly paralleled in the Axinellidæ than in the Renierinæ (*cf. Axinella, Acanthella*). This unusual condition is due to an enormous development of gelatinous mesodermal tissues, containing large stellate cells.

Locality.—Inaccessible Island; depth, 90 fathoms. One specimen.

Genus *Raspailia*, Nardo (Pls. XXXIX., XL.).

1833. *Raspelia*, Nardo, Isis, p. 522.
1847. *Raspailia*, Nardo, Prospetto della fauna marina volgare del veneto estuario, Venice, p. 3.

Sponge long and slender, with a dense central axis of spiculo-fibre containing much spongin, from which loose tufts of spicules radiate to the surface. Megasclera stylote or subtylostylote, sometimes strongylote. Spined echinating styli sometimes present. No microsclera.

The most characteristic feature of this genus is the external form, taken in connection with the absence of microsclera; like *Axinella*, it is a difficult genus to diagnose, and the two genera, as we have already indicated, come very near to one another.

Raspailia tenuis, Ridley and Dendy (Pl. XXXIX. figs. 2, 2*a*; Pl. XL. figs. 8, 8*a*, 8*b*).

1886. *Raspailia tenuis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5. vol. xviii. p. 482.

Sponge (Pl. XXXIX. fig. 2) of more or less erect growth (probably the branches floated in the water), consisting of a very long, slender stem,[1] giving off at first

[1] This description is taken from the larger of the two specimens, the smaller bears only a single branch.

very long, slender branches, but produced into a terminal portion which bears no branches, and which itself extends further than any of them and is indistinguishable from them excepting in being a direct continuation of the main stem. Length of sponge (=that of the main stem) 475 mm.; diameter of stem and branches about 2 to 2·5 mm. The branches are long, flexuous and string-like, and do not bear secondary branches. *Colour* in spirit greyish-yellow. *Texture* tough, string-like, with a coating of soft, friable consistence. *Surface* roughened with minute monticular eminences like the surface of a file; hispid. *Oscula* minute, scattered.

Skeleton.—There is a slender axial core of dense, amber-coloured horny matter containing only a few slender spicules; this core merges into a thick cylinder composed of obliquely (sublongitudinally) arranged, closely placed spicules, which, when seen in longitudinal section, present an irregular lattice-like arrangement, crossing one another at acute angles. Transverse sections of the stem or branches show that there is also an arrangement of stouter stylote spicules radiating from the central horny axis to the circumference, beyond which they project like the spokes of a wheel. The skeleton is much more strongly developed in the lower part of the stem than in the branches, and a transverse section of this region bears under the microscope a most striking resemblance to the flat bottom of a circular basket, the spicules representing the twigs of which it is composed. In the branches the sheath of spicules surrounding the horny axis is much thinner, and is covered with a thick coating of brownish-yellow, granular choanosome containing the canal system and flagellated chambers. We have already mentioned the large, radiating stylote spicules which project beyond the surface of the sponge; each of these as it leaves the sponge is surrounded by a faggot-like bunch of very small, slender styli, which also have their apices projecting outwards.

Spicules.—Megasclera; (1) very long, smooth, slender styli (Pl. XL. fig. 8); straight, or nearly so; usually, but not invariably, tapering very gradually to a very fine point at the apex, size up to about 1·75 by 0·018 mm. (2) Smooth, slender strongyla (Pl. XL. fig. 8*b*), measuring up to about 0·77 by 0·01 mm. (3) Very slender, smooth styli, surrounding the large ones as above mentioned, size about 0·42 by 0·0035 mm. (4) Small, spined styli, of rare occurrence (very rare or absent except near the base of the main stem), found radiately disposed, completely embedded in the densest parts of the spicular skeleton; spines rather large compared to the size of the spicule, short and usually recurved towards its base; size of spicule about 0·175 by 0·0125 mm. A few of the slenderer amongst the smooth styli taper so much towards the base as to become almost or sometimes quite oxeote (Pl. XL. fig. 8*a*, *b*).

This species comes very close to Bowerbank's *Dictyocylindrus hispidus*,[1] but differs from it in its mode of branching and in the presence of the smooth, cylindrical spicules (strongyla), which seem to replace the unequal-ended oxea found in the latter species.

[1] *Vide* Mon. Brit. Spong., vol. iii. pl. xvii.

The rarity of the spined stylote spicules and their occurrence mainly (almost solely) in the oldest part of the sponge suggest the possibility of their being rudimentary and derived from some ancestral form which possessed them in abundance.

Locality.—Off Bahia ; shallow water. One specimen.

Off Bahia ; depth, 7 to 20 fathoms. One specimen.

Raspailia flagelliformis, Ridley and Dendy (Pl. XXXIX. fig. 1).

1886. *Raspailia flagelliformis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 482.

Sponge (Pl. XXXIX. fig. 1) erect, stipitate, branched ; stem short and stout, rigid ; branches cylindrical, very long and slender, flexible and whip-like ; tapering slightly towards the free end and never anastomosing with one another. Total length of sponge about 425 mm.; length of stem 44 mm.; greatest diameter of same 12·5 mm.; diameter of branches about 4 mm. *Colour* in spirit yellowish-grey. *Texture ;* each branch consists of a dense, tough, horny looking axis, of darkish colour, coated with a thick layer of a soft, rather friable, yellowish substance, which is easily peeled off so as to leave the axis clean. *Surface* very minutely hispid. *Oscula* small, scattered.

Skeleton.—Containing a very large proportion of horny matter accumulated in a well-defined central axis which is also densely charged with the stylote spicules. In this central axis the spicules are arranged in not very definite tracts, which, instead of being truly longitudinal in direction, are slightly oblique, and cross one another at very acute angles, giving rise to a somewhat lattice-like arrangement ; the spicules are, however, very densely packed throughout the whole axis, so that no large open meshes appear. From the central axis there radiate outwards and obliquely upwards, through the soft tissues towards the surface of the branch, abundant but loose bands of spiculo-fibre, formed of spicules like those found in the axis ; these bands terminate at the surface in a dense velvet-like pile, composed of tufts of small, slender, stylote or subtylostylote spicules whose apices project for a very short distance beyond the surface.

Spicules.—Megasclera ; of one form only, viz., smooth, very slender styli, straight or nearly so, very sharply but not very gradually pointed at the apex ; measuring in the surface tufts about 0·3 by 0·0032 mm. (very often shorter), and in the deeper parts of the sponge about 0·45 by 0·009 mm.

This sponge has a considerable resemblance both in external form and in its spiculation to *Raspailia australiensis*, Ridley,[1] from Port Darwin, but differs in being branched, in its thicker and more friable cortical layer, and in the smaller size of its spicules ; with the exception of the character of the external form, the same remarks apply to its relations to the reticulate *Raspailia clathrata*, Ridley[2] from Torres Strait.

Locality.—Simon's Bay, Cape of Good Hope ; depth, 10 to 20 fathoms. One specimen.

[1] Zool. Coll. H.M.S. "Alert," Brit. Mus., 1884, p. 460, pl. xlii. figs. *m*, *m'*.

[2] *Op. cit.*, p. 461, pl. xli. fig. F.

Raspailia (*?*) *rigida*, Ridley and Dendy (Pl. XXXIX. fig. 3).

1886. *Raspailia* (*?*) *rigida*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 483.

Sponge (Pl. XXXIX. fig. 3) commencing as a slender stem only 2·5 mm. in diameter and gradually expanding upwards, without any sudden break, to a diameter of a little over 4 mm.; approximately straight; giving off one short, stout, abnormal-looking branch. Height of specimen 121 mm. *Colour* in spirit yellowish-grey. *Texture* firm, tough; the sponge is subrigid, not very elastic nor flexible; the difference in this respect between *Raspailia flagelliformis*, nobis, and the present species being due to the absence in the latter of a stout, dense, horny axis. *Surface* very distinctly hispid.

Skeleton.—There is a dense central axis of closely packed, stout, tylostylote or subtylostylote spicules, arranged longitudinally and parallel with one another, and with their apices directed upwards. From this axis radiate towards the surface rather sparse bands composed of similar spicules, terminating in great divergent brushes, which are again composed of the same kind of spicule (and also of some of larger size) with little more than their bases embedded in the soft tissues and projecting for a long way beyond the surface. There appears to be little or no horny matter present in any part of the skeleton.

Spicules.—Megasclera; of one kind only, viz., large, straight, smooth tylostyli or subtylostyli, very finely and gradually pointed and usually with distinct, subglobular heads; size variable, up to about 2·0 by 0·025 mm.; usually smaller, especially in the dermal brushes, whose component spicules commonly measure up to about 1·0 mm. in length.

The spicules of this species are extremely large for the genus to which it is referred. The peculiarities of its external characters have been already noticed. It is doubtful whether it is a *Raspailia* at all, or even an Axinellid; it presents strong resemblances to the genus *Suberites*.

Locality.—Station 142, December 18, 1873; lat. 35° 4′ S., long. 18° 37′ E.; Agulhas Bank, Cape of Good Hope; depth, 150 fathoms; bottom, green sand; bottom temperature, 47°·0. One specimen.

Genus *Dendropsis*,[1] Ridley and Dendy (Pls. XXXVIII., XL., XLVI.).

1886. *Dendropsis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 483.

Sponge erect, ramose. Skeleton arrangement *Raspailia*-like; megasclera stylote (one form of which may be characterised by the presence of two sharp spikes projecting from the base). Microsclera present in the form of minute spined oxea.

We have only a single species of this remarkable genus, but the characters are such as to separate it widely from all existing genera. Notwithstanding the presence of the minute spined oxea we are disposed to place the genus amongst the Axinellidæ, for the

[1] So called because of the resemblance which the type species bears to a small tree.

relations of this rare form of spicule in other sponges are so obscure as to afford no apparent clue to its classificatory importance, if it has any. As examples of other genera in which it occurs we may cite *Spongilla* and *Higginsia*.

Dendropsis bidentifera,[1] Ridley and Dendy (Pl. XXXVIII. fig. 1; Pl. XL. figs. 7, 7*a*, 7*b*, 7*c*; Pl. XLVI. fig. 8).

1886. *Dendropsis bidentifera*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 483.

Sponge (Pl. XXXVIII. fig. 1) erect, stipitate, dichotomously branched; stem cylindrical, branches flattened (especially towards their apices), and all approximately in the same plane. The largest specimen has a total height of about 200 mm.; the stem is 75 mm. long and about 8 mm. in diameter; the branches are at first of nearly the same diameter as the stem, but lessen upwards. *Colour* in spirit greyish-yellow. *Texture* tough and hard. *Surface* rough, with numerous minute prominences, and hispid.

Skeleton.—There is a dense, compact, axial core (Pl. XLVI. fig. 8, *a*) of closely interlacing, for the most part sublongitudinally disposed, smooth stylote spicules; from this central axis very much larger, stout, smooth, stylote spicules radiate to the surface, beyond which the apices of many of them project. Usually these spicules occur in loose bundles or bands of three or four together, the bases of those nearest to the centre being embedded in the axial core; they are surrounded by dense sheaves (Pl. XLVI. fig. 8, *b*) of the characteristic stylote spicules, the apices of which also often project beyond the surface.

Spicules.—(*a*) *Megasclera;* (1) smooth, stout, sharply pointed styli (Pl. XL. fig. 7, *a*), commonly with a rather sharp bend towards the base, towards which also the spicule usually narrows; in the dense central axis these spicules commonly measure about 0·35 by 0·025 mm.; these are, however, very much smaller than those radiating to the surface, which measure about 1·1 by 0·044 mm. There occur also very long and slender, smooth styli (Pl. XL. fig. 7, *a*); these are not nearly so abundant as either of the foregoing, but still can hardly be called rare; they are of variable size, and may measure about 1·75 by 0·02 mm.; sometimes, through the blunting and rounding off of the apex, the long slender styli give rise to strongylote spicules (Pl. XL. fig. 7, *b*). (2) The "bidentate" styli (Pl. XL. figs. 7, *c*, 7*a*, 7*b*); long, straight, slender, slightly fusiform and hastately pointed, each with two small, sharp spikes projecting from the base, which may be slightly enlarged. In the base the axial thread is also slightly enlarged, and seems to give off a branch to each spike. These spicules are very constant in shape and size, measuring about 0·56 by 0·0075 mm.; their disposition in the sponge has already been indicated. (*b*) *Microsclera;* small, entirely spined oxea (Pl. XL. fig. 7*c*), each one having usually a rather sharp bend in the centre; size about

[1] So-called from the presence of the two spikes on the base of the characteristic stylus.

0·09 by 0·0045 mm.; the spines are sharp, prominent, and very abundant, except in the centre of the shaft, where they are rather scarce.

This remarkable sponge is one which may be easily recognised both by its external appearance and by its spiculation, the latter being quite unmistakable.

The skeleton is arranged on decidedly an Axinellid type, especially as regards the manner in which the large, radiating, stylote spicules are surrounded by dense sheaves of small, slender styli. The general appearance of the sponge is thus decidedly Axinellid, but no sponge belonging to this group has hitherto been found with the spined oxeote microsclera, which closely agree in form with the microsclera of *Spongilla lacustris*.

Locality.—Simon's Bay, Cape of Good Hope; depth, 10 to 20 fathoms. Two specimens.

Genus *Thrinacophora*, Ridley (Pls. XXIII., XXIV., XXXVI., XL.).

1885. *Thrinacophora*, Ridley, Narr. Chall. Exp., vol. i. pt. ii. p. 572.
1886. *Thrinacophora*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 483.

Sponge ramose, with a dense central axis of spiculo-fibre; megasclera styli and (or) oxea, and (in some species) cladostrongyla. Microsclera present in the form of trichodragmata.

This genus was first founded by Ridley (*loc. cit.*), for the reception of the very remarkable species which we have called *Thrinacophora funiformis*. It was at first thought that the curious furcation of one of the megasclera in this species would prove to be a character of generic importance, but our subsequent examination of the collection disclosed another sponge (*Thrinacophora cervicornis*), which agrees so closely with *Thrinacophora funiformis* that the two seem to us to be, at any rate for the present, generically inseparable, although the former possesses none of the branching spicules. Hence we have decided that in this case, as in the Desmacidonidæ, the microsclera are the most reliable guides to classification, and we consider the presence of the trichodragmata, taken in conjunction with the Axinellid arrangement of the skeleton, as the most important generic character. This one character separates the genus at once and absolutely from all other known genera of Axinellidæ.

Possibly the branched spicule of *Thrinacophora funiformis* is comparable to the "bidentate" stylus of the only known species of *Dendropsis*, and it is noteworthy in this connection that both these genera stand apart from the remaining Axinellidæ in the possession of microsclera, though the microsclera are of very different form in the two cases. We have already[1] had occasion to point out the special bearing of the presence of a branched spicule in *Thrinacophora funiformis* upon the question of the relationship of the Monaxonida to the Tetractinellida.

[1] *Ann. and Mag. Nat. Hist.*, ser. 5, vol. xviii. p. 157.

Thrinacophora cervicornis, Ridley and Dendy (Pl. XXXVI. fig. 1; Pl. XL. figs. 4, 4*a*).

1886. *Thrinacophora cervicornis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 483.

Sponge (Pl. XXXVI. fig. 1) erect, branching dichotomously, subcylindrical, flattened towards the points of furcation; altogether much resembling a stag's antler. Total height 175 mm.; diameter of stem about 6 mm., of branches about the same or a little less. *Colour* in spirit greyish-yellow. *Texture* firm and tough, stem and branches flexible and very elastic. *Surface* beset with minute monticular eminences, so as to resemble the surface of a coarse file; from each of these eminences there projects, where the surface is uninjured, a single, very long, setiform spicule, extending for 3 or 4 mm. beyond the surface.

Skeleton.—When the sponge is microscopically examined it is readily seen that it possesses a thick central axis of horny consistency and appearance, which gives to it its firm and elastic character, and which is surrounded by a comparatively thin external coat of choanosome which readily peels off. After mounting in balsam the horny matter is no longer apparent, and in the place of the central axis we see a dense reticulation of short oxeote spicules, appearing almost uniserial in arrangement, without any distinct fibre. It is this dense reticulation of spicules, all united together by horny cementing material, which gives rise to the central axis. In the soft layer which coats the axis there are numerous long and very slender oxeote and stylote spicules, arranged longitudinally, but in no definite order; the short oxea also occur scattered in a similar manner outside the axis. We have already mentioned the very large, setiform (stylote) spicules, which project for a long distance beyond the surface of the sponge and give rise to a coarse hispidity; these have their bases embedded in the central axis, from which they project at right angles; each one as it leaves the sponge is surrounded by a whorl or tuft of divergent spicules of very much smaller size. These are very slender styli (? occasionally oxea), whose divergent ends project for a short distance beyond the dermal membrane. Sometimes two of the large styli come out together.

Spicules.—(*a*) *Megasclera;* (1) short, stout oxea (Pl. XL. fig. 4, *b*), rather abruptly and usually very sharply pointed, occasionally unequal-ended, with the large end very blunt; size about 0·28 by 0·018 mm.; occurring mainly in the axis and forming the greater portion of the skeleton. (2) The long, smooth styli projecting from the surface; these are almost straight and measure about 5·2 by 0·037 mm. (3) The straight, smooth, slender styli (Pl. XL. fig. 4, *a*) projecting in whorls around the last mentioned; these are usually sharply pointed, but sometimes become blunted at the apex; size about 0·52 by 0·0075 mm. The long, slender oxea, styli and strongyla, longitudinally disposed in the choanosome, are to be regarded merely as slight varieties of (3) and measure about the same. (*b*) *Microsclera;* trichodragmata (Pl. XL. fig. 4*a*), fairly plentifully

cattered in the soft tissues, length about 0·0126 mm.; breadth extremely variable; these bundles appear of a distinctly brown colour, a character which is also noticeable in *Thrinacophora funiformis*, nobis.

In the arrangement of the skeleton and the general form of the megasclera, and in the possession of trichodragmata, this sponge bears a most marked resemblance to *Thrinacophora funiformis*, nobis, and the two are evidently very nearly related. The characteristic forked spicules of the latter are represented in the present species by the slender styli, and have probably been derived from some such form of spicule (or possibly *vice versâ*).

We placed this species first in the genus because we considered it to be the least highly modified of the two.

Locality.—Station 208, January 17, 1875; lat. 11° 37′ N., long. 123° 31′ E.; Philippine Islands; depth, 18 fathoms; bottom, blue mud. Two specimens.

Thrinacophora funiformis, Ridley and Dendy (Pl. XXIII. figs. 1, 1*a*, 1*b*, 1*c*, 1*d*, 1*e*, 1*f*, 1*g*; Pl. XXIV. figs. 1, 1*a*, 1*b*).

1886. *Thrinacophora funiformis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 484.

Sponge (Pl. XXIV. figs. 1, 1*a*, 1*b*) of fairly definite form; always cylindrical and more or less elongated; may or may not be branched. The largest specimen in the collection is unbranched except close to the base, where there is a slight trace of branching; it is about 450 mm. long,[1] flexible and rope-like, and about 6 mm. in average diameter. A second specimen (Pl. XXIV. fig. 1*a*) evidently younger, is of very different and more definite form. Arising from a flattened and expanded base there is a short, straight peduncle, which, at a height of about 12 mm., divides into two branches, one of which again divides into two. Total height about 81 mm. Sponge composed of a dense, fibrous axis with a soft external coat of a pulpy consistency. *Colour* in spirit dirty yellow. *Surface* very uneven, thickly beset with rather stiff, small, projecting conuli. *Dermal membrane* distinct and very granular. *Oscula* small, scattered. *Pores* not seen (the specimens are not in very good condition).

Skeleton.—There is a very thick and dense central axis of spiculo-fibre from which other fibres radiate to the surface, there entering into the numerous projecting conuli. It is not easy to make out any other definite skeleton, although there are a great number of spicules scattered through the soft tissues of the sponge.

Spicules.—(*a*) *Megasclera;* (1) long, slender styli (Pl. XXIII. figs. 1*a*, 1*b*), straight or curved, with evenly rounded base and tapering very gradually to a very fine point at the apex; size very variable, up to about 1·8 by 0·025 mm. (2) Long, slender, unequally

[1] The end appears to have been broken off; doubtless the specimen when perfect was a little longer, though probably not much.

ended oxea (Pl. XXIII. fig. 1); with the large end slightly uneven near the point and tapering rather suddenly; at the small end tapering very gradually to a very fine point, or irregular; size very variable, up to about 1·7 by 0·023 mm. There can be little doubt that these spicules are merely modifications of (1). (3) Much shorter, equal ended, fusiform oxea (Pl. XXIII. figs. 1*c*, 1*d*); usually sharply pointed at each end, but with the ends often rather uneven, usually with a rather sharp bend in the centre; size variable, up to about 0·6 by 0·023 mm. (4) Spicules of a very peculiar form, cladostrongyla (Pl. XXIII. figs. 1*e*, 1*f*); each consisting of a slightly crooked shaft of even diameter all along; terminating at one end in an evenly rounded extremity and at the other dividing into a number (usually about three) of very irregular, short branches, like the fangs of a human tooth. Size fairly uniform, up to about 0·52 by 0·0063 mm. These spicules often occur together in bundles, like faggots of wood, sometimes surrounding the larger megasclera; they also occur fairly abundantly in the dermal membrane, where they are scattered separately. It is well worthy of note that the axial thread itself forks with the forking of the spicule. (*b*) *Microsclera;* of one kind only, viz., trichodragmata (Pl. XXIII. fig. 1*g*), occurring abundantly scattered through the soft parts of the sponge, especially in the dermal membrane, in parts of which they form an almost continuous layer. They have the form of small, oblong bundles, measuring about 0·1 by 0·01 mm. Though usually fairly compact these bundles seem readily to break up into a multitude of component spicules which are exceedingly fine and hair-like.

This species is at once distinguished by the presence of the peculiar forked megasclera.

Locality.—Off Bahia; depth, 7 to 20 fathoms. Two good specimens and four fragments.

Off Bahia; shallow water. One specimen.

(?) Off Bahia; shallow water.[1] One large specimen and two fragments. The large specimen is composed of two long, straight pieces, which have grown up parallel with one another from a common basal portion, and have fused together for a considerable part of their length.

Suborder II. CLAVULINA, Vosmaer.

1885. *Clavulina*, Vosmaer, Bronn's Klass. u. Ordnung. d. Thierreichs, Porifera, p. 328.

Sponge typically corticate. Skeleton usually more or less radiately arranged, with a dermal crust of spicules which may be either of the same form as in the main skeleton or of a special form (spined spirulæ, &c.). Megasclera typically tylostylote. Microsclera, when present, belonging almost invariably to the stellate group; never chelæ or sigmata. Spongin usually absent.

[1] According to the inside label; the outside label had—"Off Bermuda." There can, however, be little doubt that Bahia is the correct locality.

Family I. Suberitidæ.

No microsclera present.

Genus *Suberites*, Nardo (Pls. XXV., XLI., XLIII., XLV.).

1833. *Suberites*, Nardo, Isis, p. 523.
1864. *Hymeniacidon, pars*, Bowerbank, Mon. Brit. Spong., vol. i. p. 191.

Form various, massive to stipitate. Surface devoid of mammiform projections. Skeleton radiately arranged, nearly always with a dermal crust of smaller spicules arranged vertically to the surface. Spicules all monactinal, nearly always tylostylote.

This genus appears to be the most primitive of the family, giving rise on the one hand to mammæ-bearing forms such as *Polymastia*, &c., and on the other to symmetrically radiate forms like *Trichostemma*.

The most interesting of the new species obtained by the Challenger are several stipitate forms which in varying degrees simulate the genus *Stylocordyla* in external appearance (*e.g.*, *Suberites ramulosus*, nobis), always differing, however, from that genus in the presence of monactinal in place of diactinal megasclera.

Suberites carnosus, Johnston, sp.

1842. *Halichondria carnosa*, Johnston, British Sponges, p. 146, pl. xiii. figs. 7–8.
1866. *Hymeniacidon carnosa*, Bowerbank, Mon. Brit. Spong., vol. ii. p. 203; vol. iii. pl. xxxvi. figs. 5–9.
1884. *Suberites carnosus*, Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., 1884, p. 465.

The occurrence of this sponge at or near Port Jackson has already been noted by Ridley (*loc. cit.*); it appears to be a very widely distributed species, as will be seen from the list of localities in which it has been found, as given below. The Challenger obtained it off the Azores and off Port Jackson, and a variety of the same species from Fernando Noronha.

Localities.—Station 75, July 2, 1873; lat. 38° 38′ 0″ N., long. 28° 28′ 30″ W.; off the Azores; depth, 450 fathoms; bottom, volcanic mud. One specimen.

Off Port Jackson; depth, 6 to 15 fathoms. One specimen.

Off Fernando Noronha, September 1, 1873. One specimen of a slight variety, in which the arrangement of the skeleton fascicles at the surface of the sponge is more diffuse than usual. The spicules, also, are larger than usual, measuring in the deeper parts of the sponge about 0·56 by 0·008 mm., and the head varies much in size and is often very irregular in shape; occasionally it may even be absent.

Habitat.—British Isles (Johnston, Bowerbank, &c.); Azores (Challenger); Fernando Noronha (Challenger); Kerguelen Island (Carter); Vancouver's Island (?) (Carter); Port Jackson ("Alert," Challenger).

Suberites caminatus,[1] Ridley and Dendy (Pl. XLI. fig. 2; Pl. XLV. figs. 5, 5*a*, 5*b*, 5*c*, 5*d*).

1886. *Suberites caminatus*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 484.

Sponge (woodcut, Fig. 7) massive, roughly hemispherical, sessile, corticate, resembling in shape and size *Esperella mammiformis*, nobis. The single specimen in the collection is attached by a broad base to an empty Brachiopod shell and terminates in a single oscular projection at the apex. The base is not round but oval, and the longer diameter measures 19 mm., and the shorter about 13 mm. Height of sponge about 13 mm. *Colour* in spirit light, greyish-yellow. *Texture* very firm, hard and compact. *Surface* even, but very minutely hispid and rather harsh to the touch; also marked with shallow meandering and anastomosing grooves, so as to become faintly tesselated. *Osculum* (Fig. 7, *o*) single, small, tubular, at the summit of the sponge. *Pores* difficult to make out, almost certainly in the shallow grooves on the surface; seen in section leading into elongated subdermal cavities between the skeleton fascicles of the cortex.

Fig. 7.—*Suberites caminatus*; attached to a Brachiopod shell; *o*, osculum.

Skeleton.—There is a very dense and definite cortex (ectosome), about 0·63 mm. thick, very sharply and suddenly marked off from the underlying tissues and strengthened by closely placed fascicles of tylostylote spicules which extend right through it, and have their points directed outwards, but projecting only very slightly beyond the surface. The deeper skeleton is rather scanty and is composed of bands of spiculofibre (formed of large tylostylote spicules), which run vertically towards the surface of the sponge to join the cortical layer.

Spicules.—Megasclera; of one form only, viz., smooth tylostyli (Pl. XLV. figs. 5, 5*a*, 5*b*, 5*c*, 5*d*). There are two chief sizes, the smaller ones occurring in the cortex and the larger in the deeper skeleton; there is great variability in size; the spicules of the cortex measure about 0·35 by 0·01 mm., they are stouter in proportion to their length than are the spicules of the deeper skeleton, have well developed, roundedly triangular heads and sharp points, and are often slightly bent. The spicules of the deeper skeleton are very long, straight and slender, have rather less developed, pointedly oval heads, and taper very gradually indeed to an extremely fine point at the apex; size about 1·2 by 0·017 mm. Intermediate sizes are abundant.

This is a very pretty and interesting little sponge; it may be recognised by its external form, and more especially by the projecting, well-marked osculum. The form recalls somewhat *Tentorium semisuberites*. This and the further resemblance recorded in the variety

[1] So called from the chimney-like osculum at the summit of the sponge.

below, possibly indicate a real alliance between the species. The single specimen is remarkable for the presence of a great number of large, nucleated sperm-cells (?), which are closely packed together, so as almost entirely to fill the soft parts of the sponge.

Locality.—Off Marion Island; depth, 50 to 75 fathoms. One specimen.

We have from Station 320 an interesting series of specimens which should perhaps be considered as belonging to a slight variety of the above species; they do not, however, appear to be distinct enough from the type to justify us in giving a varietal name. They occur, for the most part, encrusting dead branches of a *Sporadopora*, on which they form colonies (Pl. XLI. fig. 2), the different cushion-like individuals being united together by their bases; there is usually more than one osculum to each individual, situated at or near the summit of the sponge. The growth appears to be altogether rather more robust and the spicules of a rather larger average size than in the type. We noticed in this variety a feature which we had not observed in the type, namely, that towards the base of the sponge the cortical layer of projecting brushes of tylostylote spicules gives place to a confused layer of short, stout, fusiform tylostyli, calling to mind the similar layer in *Tentorium semisuberites*. The sponge is further remarkable as forming colonies by continuous gemmation, in a manner very rare in siliceous sponges.

Locality.—Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; off the mouth of the Rio de la Plata; depth, 600 fathoms; bottom, green sand; bottom temperature, 37°·2. Several specimens.

Suberites microstomus, n. sp.[1] (Pl. XLI. fig. 3).

Sponge (Pl. XLI. fig. 3) sessile, hemispherical. The single specimen in the collection is about 25 mm. in diameter and is attached to a piece of black, volcanic rock. *Colour* in spirit pale yellow. *Texture* very firm and dense, with a very strongly developed, fibrous cortex (ectosome) about 0·9 mm. thick. *Surface* fairly even, minutely granulated. *Oscula* very minute, but distinct, very slightly raised above the general surface of the sponge and with no thin-walled tubular projections as in *Suberites caminatus*, nobis (*cf.* woodcut, Fig. 7 and Pl. XLI. figs. 2, 3). *Pores*, small openings between the cortical brushes of spicules, leading into large, elongated, rather lacunar subdermal cavities in the cortex.

Skeleton.—The main skeleton is very well developed and composed of very stout bands of spiculo-fibre, which radiate to the surface, expanding at their ends in a brush-like manner and merging in a distinct cortical layer composed of dense brushes of much smaller, radiately disposed spicules, whose apices project for some distance beyond the surface of the sponge. It is important to notice that the special cortical layer of spicules

[1] This is the sponge referred to in our Preliminary Report (*Ann. and Mag. Nat. Hist.*, ser. 5, vol. xviii. p. 485) as a slight variety of *Suberites caminatus*, nobis, with very small, non-tubular oscula.

occupies only the upper quarter of the cortex, and that the spicules composing it project beyond the surface for nearly half their length. The lower three quarters of the thick ectosome are penetrated and strengthened only by the ends of the main skeleton fibres. (Compare this arrangement with that found in *Suberites caminatus*, where the cortical layer of spicules occupies nearly or quite the entire thickness of the ectosome.)

Spicules.—Megasclera; all tylostylote. (1) Large, stout, straight, gradually and very sharply pointed, with very slightly developed heads, which are a little elongated; size up to about 1·2 by 0·02 mm. These spicules occur in the fibres of the main skeleton. (2) Much smaller, straight or slightly curved, slender, gradually and sharply pointed, with heads more distinctly marked and usually of the shape termed by Bowerbank "enormispinulate," size variable, say about 0·3 by 0·006 mm. These spicules form the special cortical skeleton and also occur in bundles or tracts in the deeper parts of the sponge.

We at first put this species down as a slight variety of *Suberites caminatus*, nobis, but our subsequent more careful examination of it has proved it to be really quite distinct, although in many respects the two species resemble one another. The most important points of difference concern (1) the oscula, which are minute and non-tubular; (2) the arrangement of the cortical skeleton (*vide supra*); (3) the form and size of the cortical spicules, which in the present species are much smaller and slenderer than in *Suberites caminatus*. In minute histological characters, however, the two species come very close to one another.

Locality.—Station 150, February 2, 1874; lat. 52° 4′ S., long. 71° 22′ E.; between Kerguelen and Heard Islands; depth, 150 fathoms; bottom, coarse gravel; bottom temperature, 35°·2. One specimen.

Suberites perfectus, Ridley and Dendy (Pl. XLI. fig. 9; Pl. XLV. figs. 3, 3*a*, 3*b*).

1886. *Suberites perfectus*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 485.

Sponge (Pl. XLI. fig. 9) erect, lobose. The single specimen in the collection is a simple, upright, subcylindrical lobe, 81 mm. high by about 19 mm. in diameter. *Colour* in spirit brownish-yellow. *Texture* hard, firm, very slightly compressible. *Surface* minutely reticulate, almost glabrous in appearance but in reality very minutely hispid, harsh to the touch, fairly even. *Dermal membrane* fairly distinct, but reduced to a network by the very numerous pores. *Oscula* small, very abundant, irregularly scattered, each on the summit of a small projection. *Pores;* the surface of the sponge, as already stated, is minutely reticulate; it is divided into a number of oval meshes by a network of tissue; each mesh is about 0·2 mm. in diameter and is subdivided into smaller meshes by the delicate, cribriform dermal membrane which stretches across it; there are thus larger and smaller meshes, the larger meshes containing some half dozen of the

smaller, which are about 0·07 mm. in diameter and are the true pores; these pores lead into well-developed subdermal cavities between the ends of the radiating skeleton fascicles.

Skeleton.—Radiately arranged, composed entirely of tylostylote spicules. There is a dermal crust of small tylostylote spicules arranged in closely placed, but not very tightly packed, divergent brushes, the points of the component spicules projecting freely beyond the dermal membrane and giving rise to the hispidity already mentioned. The main skeleton is composed of radiating fascicles of large tylostylote spicules, running vertically to the surface and there ending in the brushes of small spicules which form the dermal crust; between these main fascicles are scattered other tylostylote spicules.

Spicules.—Megasclera; of one form only, viz., smooth tylostyli (Pl. XLV. figs. 3, 3*a*, 3*b*), straight or slightly crooked, slightly fusiform, with well-developed, hemispherical or nearly globular heads, and fairly sharply but rather suddenly pointed at the apex. These spicules are very variable in size; small ones are found in the dermal crust and large ones in the deeper parts of the skeleton; the range in length is about from 0·2 to 1·2 mm. and in diameter about from 0·0078 to 0·03 mm. The spicules of the dermal crust commonly measure about 0·28 by 0·0126 mm.; those of the deeper skeleton about 1·0 by 0·025 mm.; but there is great variation.

This is a remarkably fine species and shows the oscula and pores (which are often extremely difficult to make out in the genus *Suberites*) very distinctly.[1] Its distinguishing characters are the general external appearance, the hard texture and the incipient stalk; in the latter point it approaches *Suberites axiatus* (below).

Locality.—Port Jackson; depth, 30 to 35 fathoms. One fine specimen.

Suberites antarcticus, Carter (Pl. XLV. fig. 7, 7*a*, 7*b*, 7*c*, 7*d*).

1876. *Suberites antarcticus*, Carter, Ann. and Mag. Nat. Hist., ser. 4, vol. xviii. p. 391.

Sponge erect, much branched, bushy; branches long, cylindrical, may anastomose on coming into contact with one another. Total height of Challenger specimen about 150 mm.; greatest breadth about 50 mm., diameter of branches 6 to 8 mm. *Colour* in spirit black (colouring (?) the spirit deep amber).[2] *Texture* firm, but a little spongy. *Surface* fairly even, but minutely reticulate and also very minutely hispid; harsh to the touch. *Dermal membrane* delicate, transparent, difficult to make out. *Oscula* numerous, small, distinct, scattered over the branches, sometimes placed serially one above the other, each on the top of a small, low papilla. The excretory canals can be very distinctly seen through the skin, converging towards the oscula in a stellate manner. *Pores* apparently arranged as in *Suberites perfectus*, nobis, but not clearly made out.

[1] Further details with regard to the anatomy and histology will be found in the Introduction.

[2] It is possible that this colour is due to other sponges packed in the same vessel, but Mr. Carter's type specimen in the British Museum seems to indicate otherwise.

Skeleton.—In each branch there is a central axis, formed of a very dense reticulation of closely packed, tylostylote spicules. These pass into rather loose and irregular, radiating fascicles of spicules, which terminate in a "dermal crust," composed of divergent brushes of tylostylote spicules whose points project very slightly beyond the surface. Just below the surface there also occur a few more or less horizontally placed spicules, which, together with the radiating brushes, are so arranged as to give to the surface its reticulate appearance.

Spicules.—Megasclera; of one kind only, viz., smooth tylostyli (Pl. XLV. figs. 7, 7*a*, 7*b*, 7*c*, 7*d*), almost or quite straight, with well-developed, nearly globular heads and slightly fusiform shafts, tapering very gradually to a very sharp point at the apex. In size these spicules vary very much, smaller ones being found towards the outside and larger ones in the centre of the sponge. Often in the case of the smaller spicules the head and neck are bent at a slight angle to the remainder of the shaft. The spicules vary in length from about 0·175 to about 0·875 mm., and in diameter from about 0·0094 to about 0·025 mm.; the spicules in the dermal crust being commonly about 0·28 mm. and those of the deeper parts about 0·7 mm. long.

Mr. Carter refers twice in the Annals and Magazine of Natural History to his *Suberites antarcticus*,[1] and as his type of the species (dry) is in the British Museum there is no doubt as to what the species really is, although it has not hitherto been fully described. The above description is taken entirely from the Challenger specimen, which is a very fine one, and preserved, of course, in spirit. In Mr. Carter's specimens the branches are much more flattened and very much more anastomosing than in the Challenger example.

It will be seen that this species comes near to *Suberites perfectus*, nobis, but it differs from it in its manner of growth and in its extraordinary dark colour (?), which may be a very characteristic feature. There are also slight differences between the spicules of the two species, but these do not amount to much.

Locality.—Off Christmas Harbour, Kerguelen; depth, 70 fathoms. One specimen.

Habitat.—Antarctic Seas (Carter); Kerguelen (Challenger).

[1] *Loc. cit. supra* and *Ann. and. Mag. Nat. Hist.*, ser. 5, vol. ix. p. 350. Mr. Carter here says:—"Dredged by Sir James Ross in 74½° S. lat., in 206 fathoms (Expedition of 1841), undescribed. *Character.* Stipitate branched; branches digitate, nodose, pollachotomous; structure subcavernous; colour dark house-mouse; spicule pin-like, with large *spherical* head. Size of specimen about 5½ × 3 inches."

Suberites axiatus, Ridley and Dendy (Pl. XLV. figs. 15, 15*a*, 15*b*, 15*c*).

1886. *Suberites axiatus*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 485.

Sponge irregular in shape, lobose or digitate. Unfortunately the species is represented in the collection only by a few fragments in very bad condition; they are now of a dull, reddish-yellow colour (like many other specimens from the same station), which appears to have been caused by their having been packed in some iron vessel which has rusted and discoloured the spirit. *Texture* soft and spongy, with a thick, dense axis up the centre of the branches. *Surface* hispid.

Skeleton.—There is a dense, stout, central axis of longitudinally placed spicules, which, though closely packed, are not firmly united together, so that the axis is readily broken across, leaving at each broken end a mass of projecting spicules which have been pulled out from amongst their fellows. From this axis radiate bands of spiculo-fibre to the surface of the sponge, where the spicules diverge and give rise to more or less of hispidity. The radiating fibres do not usually come off at right angles from the axis but more or less obliquely, so that when a branch is broken across the broken end has the form of a cone on the one hand, and of a funnel, into which the cone fits, on the other.

Spicules.—Megasclera; of one form only, viz., tylostyli (Pl. XLV. figs. 15, 15*a*, 15*b*, 15*c*), with fairly well-developed, subglobular heads and fusiform shafts, tapering gradually to a sharp point at the apex. Size very variable; the larger spicules, in the interior of the sponge, measure about 1·75 by 0·031 mm., but towards the outside of the sponge the spicules become very much shorter and slenderer, commonly measuring about 0·7 by 0·0126 mm.

The most remarkable point about this species is the very strongly developed axis; it will be seen to approach closely to Carter's species *Suberites antarcticus*, but differs in habit, in colour, and in the much greater size of the spicules.

Locality.—Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; off the mouth of the Rio de la Plata; depth, 600 fathoms; bottom, green sand; bottom temperature, 37°·2. Fragments.

Suberites durissimus, Ridley and Dendy (Pl. XLI. fig. 1; Pl. XLV. figs. 2, 2*a*, 2*b*, 2*c*, 2*d*, 2*e*).

1886. *Suberites durissimus*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 485.

Sponge (Pl. XLI. fig. 1) pedunculate, form rather irregular. The single specimen in the collection consists of a basal, rhizome-like portion, from which arise two stalks, each bearing an expanded, oval or subglobular head; in the case of the smaller one the peduncle is produced upwards beyond the expanded head, while the larger is broadly and evenly rounded at the top. The smaller stalk gives off, near its base, a flattened process

ending in a third, small, globular head. Total height of specimen 56 mm.; diameter of largest head 15 mm.; diameter of largest peduncle 6 mm. *Colour* in spirit light, greyish-yellow. *Texture* solid throughout, hard, incompressible and woody. *Surface* even, but covered with a velvet-like pile.

Skeleton.—Radiately arranged, very dense, consisting of closely packed fascicles of spicules radiating towards the surface. There is a dermal crust of thickly packed, projecting, tylostylote spicules, and below this come the main skeleton fascicles, composed mainly of stylote spicules; (we have been unable to determine with certainty whether any of these large styli project beyond the surface of the sponge and take part in the formation of the velvet-like pile, or whether the latter is formed entirely of tylostylote spicules). The dermal crust of spicules is continuous all over the surface, but every alternate fascicle of the main skeleton stops short a little way below the surface and before it reaches the bottom of the dermal crust, and thus arise a number of fairly definite spaces, devoid of spicules, which seem to be comparable to the subdermal cavities of other Monaxonida.

Spicules.—Megasclera; (1) tylostyli (Pl. XLV. figs. 2*a*, 2*b*, 2*c*), straight or nearly so, with well-developed, almost globular heads, fusiform shafts, and sharply and gradually pointed at the apices. These occur mainly in the dermal crust, with their points directed outwards; a common size for them is about 0·24 by 0·0063 mm., but in this respect they vary extremely, and they pass by a series of transitional stages (both as regards form, size, and position) into (2) the deeper spicules found in the main skeleton fascicles. These spicules are very long, straight, slender, smooth, fusiform styli and subtylostyli (Pl. XLV. figs. 2, 2*d*, 2*e*), very gradually and sharply pointed at the apices; size about 1·5 by 0·0157 mm.; having their apices generally (? always) directed outwards.

This is one of those species which appear to mark a transition in external form from *Suberites* to *Stylocordyla*.

Locality.—Off the south-east coast of Australia. One specimen.

Suberites mollis, Ridley and Dendy (Pl. XLI. fig. 4; Pl. XLV. figs. 4, 4*a*, 4*b*, 4*c*).

1886. *Suberites mollis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 486.

Sponge (Pl. XLI. fig. 4) stipitate, with expanded, lobose head. The short stem is attached by a slightly expanded base to a fragment of stone, and is surmounted by the broad, lobose, slightly compressed, suboval head, bifurcating slightly at the top. Total height of sponge 31 mm., length of stem 13 mm.; diameter of same about 2·5 mm.; greatest breath of head about 13 mm. *Colour* in spirit pale yellow. *Texture* (of head) very soft and spongy; of stem, firm, but brittle, scarcely fibrous. *Surface* even, but minutely hispid. *Dermal membrane* distinct. *Pores* apparently scattered. *Oscula* (?).

Skeleton.—(*a*) The skeleton of the stem; this consists of a dense, well-defined, central

axis of longitudinally placed spicules, from which radiate bands of very loose spiculo-fibre to the surface, like the spokes of a wheel; these project more or less beyond the surface and give rise to its hispidity. (*b*) The skeleton of the head; this is very diffuse, and consists of loose bands of spiculo-fibre which run more or less vertically upwards towards the top of the sponge, radiating very slightly; as they approach the surface they break up into brushes of smaller tylostylote spicules. Owing to the direction in which they run it is only at the top of the sponge that the skeleton fibres abut vertically against the surface; lower down their direction lies more or less parallel with it, and they only run very obliquely into it.

Spicules.—Megasclera; of one kind only, viz., smooth tylostyli (Pl. XLV. figs. 4, 4*a*, 4*b*, 4*c*), with straight, or very slightly curved shafts and fairly well-developed, hemispherical or subglobular heads; tapering gradually to a fine point at the apex. Size extremely variable, in the deeper fibres very long and stout, towards the surface usually much smaller. They may attain a length of about 2·0 mm. and a diameter of about 0·03 mm.; but, as already stated, they are very much smaller in the radiating brushes at the surface of the sponge, commonly measuring about 0·4 or 0·5 by about 0·01 mm.

The most remarkable features of this sponge are its great softness and looseness of texture, as compared with the more typical species of *Suberites*, and the reduction of the "dermal crust" of spicules, which no longer forms a distinct cortical layer.

Locality.—Station 148, January 3, 1874; south of the Crozets; bottom, hard ground, gravel, shells; depth, 240 to 550 fathoms. One specimen.

Suberites elongatus, Ridley and Dendy (Pl. XLIII. figs. 11, 12).

1886. *Suberites elongata*, Ridley and Dendy, Ann. and. Mag. Nat. Hist., ser. 5, vol. xviii. p. 486.

Sponge (Pl. XLIII. figs. 11, 12) consisting of a slender, fleshy-looking stalk, expanding below into attaching rootlets; and an oval, more or less elongated head. The relation, as regards size, between the head and the stalk is a very variable one; in one specimen the head is about 12 mm. and the stalk about 44 mm. long, while in a second the head is 25 mm. and the stalk only about 12 mm. long. The respective diameters of the head and stalk are, on the contrary, pretty constant, that of the head being about 4 mm. and of the stalk 1 mm. *Colour* in spirit pale yellow. *Texture* firm, cork-like. *Surface* even, on the head minutely hispid, on the stalk still more minutely so. *Oscula* very few, minute, scattered, sometimes one or two, sometimes none, discernible; usually at or near the top of the head.

Skeleton.—The dense central axis of the stem, composed of longitudinally placed, stylote spicules, is continued into the head as a not very definite central core, from which radiate, outwards and upwards, bands of spiculo-fibre to the surface of the sponge; on approaching the surface these branch more or less and the points of their terminal spicules

project freely, and, together with a dense dermal crust of small, projecting, tylostylote spicules, give rise to the hispid character of the head. The interspaces between the radiating bands of spiculo-fibre are occupied by loosely and irregularly scattered tylostylote spicules.

Spicules.—Megasclera; (1) very long, straight, slender, smooth styli or subtylostyli, very finely and gradually pointed at the apex; size about 1·8 by 0·016 mm. (2) Much smaller, straight, slender tylostyli with well-developed, subglobular heads, and very sharply and gradually pointed at the apex; size rather variable, about 0·35 by 0·0063 mm.

As regards spiculation there is but little characteristic about this species; the great slenderness of the long stylote spicules, and the presence of a fairly well defined dermal crust of smaller tylostyli may be noted. The external form, though variable, is very characteristic; the elongated oval shape of the head and the relative shortness of the stalk being its prominent features.

Locality.—Station 75, July 2, 1873; lat. 38° 38′ 0″ N., long. 28° 28′ 30″ W.; off the Azores; depth, 450 fathoms; bottom, volcanic mud. Eight specimens.

Suberites spiralis, Ridley and Dendy (Pl. XXV. fig. 1).

1886. *Suberites spiralis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 486.

Sponge (Pl. XXV. fig. 1) erect, stipitate; cylindrical, with the stalk produced upwards, as an axis, right through the body of the sponge. Height 88 mm.; length of stalk 31 mm.; diameter of stalk 2 mm.; of body 6 mm. *Colour* in spirit pale yellow. *Texture* of stalk and axis very dense and firm; of body fairly firm, but rather open and compressible. *Surface* very minutely hispid. *Oscula* scattered over the body of the sponge.

Skeleton.—Consisting of a dense, stout, central axis of longitudinally placed spicules, from which, in the body of the sponge, radiate loose fibres to the surface, arranged in a somewhat spiral manner and terminating in loose, radiating brushes of smaller spicules with outwardly directed apices.

Spicules.—Megasclera; (1) long, slender, straight, or nearly straight, sharp-pointed tylostyli; with well-marked, but not very large, subglobular heads; size about 1·0 by 0·013 mm.; these constitute the skeleton fibres. (2) Similar, but much smaller spicules, occurring in the surface brushes, length about 0·4 mm., but not very constant.

In the presence of a distinct axis with radiating fibres this sponge resembles the Axinellidæ. The habit is decidedly that of an Axinellid, and it seems to strengthen the possibility of a close relationship between the Axinellidæ and Suberitidæ. The peculiar spiral arangement of the skeleton fibres in the body of the sponge is to be found still more distinctly shown in *Stylocordyla stipitata*, var. *globosa* (*vide* woodcut, Fig. 9).

Locality.—Off the south-west coast of Patagonia. One specimen.

Suberites ramulosus, Ridley and Dendy.

1886. *Suberites ramulosa*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 487.

Sponge stipitate, stalk slender, often crooked, simple or branched; ending below, in perfect specimens, in spreading rootlets, and expanding above into a pear-shaped head (none of the five specimens present exhibit more than one head, though two show branching of the stem, but there can be little doubt that several heads may be present, as described in the variety below, of which a much more perfect series of specimens is to hand). Size variable; the largest specimen has a stem 44 mm. long by about 1·5 mm. thick, and a head about 13 mm. long by 8 mm. broad. *Texture* rather soft and spongy, surface hispid. *Oscula;* a single one at the summit of each head, surrounded by a slight spicular fringe.

Skeleton.—Very irregular; a dense central axis of longitudinally placed, large tylostylote spicules in the stem, and in the head longitudinal tracts of similar spicules, with loose brushes of smaller ones whose points project beyond the surface and give rise to the hispidity; (compare the description of the skeleton in the variety given below, where it seems to be much more definitely arranged).

Spicules.—Megasclera; (1) large, straight, stout, fusiform tylostyli, with well-developed subglobular heads and (usually) blunt apices; size about 1·8 by 0·063 mm. (in the stem they may be a little longer and slenderer). (2) Much smaller and slenderer, long, straight, usually sharply pointed tylostyli, with well-marked, nearly globular heads; these spicules form the brushes at the surface of the sponge; their size is very variable, they commonly measure about 1·0 by 0·028 mm., but it would not be difficult to pick out a series connecting them with the larger kind. In the stem the spicules are frequently very crooked, calling to mind those of some Axinellidæ.

The chief point of interest in this species, apart from the branching of the stem, lies in its relation to a well-marked variety of the same from a neighbouring station, which is fully described below; the comparison of these two forms shows how little reliance can be placed on slight differences in the form of the megasclera, that is, whether "stylote," "strongylote," or "tylostylote," for purposes of classification. We have chosen to consider the form described above as the type, because its spicules, in the presence of well-developed heads, agree with those of more typical species of *Suberites*, while the larger spicules of the variety differ from them in this respect. The species is further of exceptional interest owing to the manner in which the external form simulates that of *Stylocordyla*.

Locality.—Station 207, January 16, 1875; lat. 12° 21′ N., long. 122° 15′ E.; Philippine Islands; depth, 700 fathoms; bottom, blue mud; bottom temperature, 51°·6. Five specimens.

Suberites ramulosus, var. *cylindrifera*[1] (Pl. XXIX. figs. 5, 5*a*; Pl. XLIII. figs. 13, 14).

1886. *Suberites ramulosa*, var. *cylindrifera*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 487.

Sponge (Pl. XLIII. figs. 13, 14) consisting of one or more heads, with long, slender, simple or branched stalks; when the stalk is simple there is only one head, but when it is branched there is a head at the end of each branch. The stalk is slender, usually more or less crooked, and ends below (in perfect specimens) in branching rootlets; at its upper end it gradually expands into the elongated, pear-shaped head, which terminates in a single osculum at the summit. When the stem is branched the branches come off from the main stem at various angles and quite irregularly; when a stem comes into contact with a head or with another stem the parts in contact may anastomose. Size of specimens variable; the finest unbranched specimen has a head which is 31 mm. long by about 13 mm. broad, and a stem about 100 mm. long by about 2·5 mm. thick. *Colour* in spirit dirty, greyish-yellow. *Texture* of head rather soft and spongy; of stem firm and fibrous. *Surface* strongly hispid. *Oscula;* normally there is a single one, surrounded by a slight spicular fringe, at the summit of each head.

Skeleton.—The skeleton of the stem consists of a dense, central axis of large, blunted stylote spicules, from which project at right angles loose tufts of smaller, subtylostylote spicules whose points project beyond the surface. That of the head consists of ascending lines of very loose spiculo-fibre, composed of the large, blunted styli, running very obliquely to the surface, where they end in loose, irregular tufts of smaller subtylostyli whose points project outwards and upwards and give to the surface its uniform hispidity.

Spicules.—Megasclera; (1) long, smooth, straight, slightly fusiform (cylindrical) styli (Pl. XXIX. figs. 5, 5*a*), evenly rounded off at the base and tapering gradually to a narrow, but rounded, apex; size about 2·6 by 0·056 mm. (2) Long, straight or slightly curved subtylostyli, with slightly developed heads and usually sharply pointed at the apex; size very variable, passing by occasional transitional forms into the larger spicules, commonly measuring about 1·0 by 0·014 mm. but often smaller.

This very interesting variety is well represented in the collection by a large number of fine specimens; indeed it is very much better represented than the more typical form of the species. A very remarkable point in connection with it is the high temperature (71°·0) of the water in which it grew; it was obtained from Station 209 only, while the types of the species were obtained from Station 207. It differs from the types mainly in the absence of heads to the larger megasclera and in their still greater bluntness, and throws considerable doubt on the specific value of these characters; differences also exist in the proportions of the spicules, which will be seen by comparison of the descriptions. As regards external form there is very little difference to note between the specimens

[1] So-called on account of the strong tendency exhibited by the larger spicules to become cylindrical.

from the two stations, save that the variety, in so far as can be judged from the specimens in the collection, seems to attain a greater size and altogether a much more luxuriant growth than does the species; possibly this is attributable to the higher temperature of the water in which it lives.

Locality.—Station 209, January 22, 1875; lat. 10° 14′ N., long. 123° 54′ E.; Philippine Islands; depth, 95 fathoms; bottom, blue mud; bottom temperature, 71°·0. A large number of specimens.

Suberites senilis, Ridley and Dendy (Pl. XLV. figs. 1, 1*a*, 1*b*).

1886. *Suberites senilis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 485.

Sponge sessile, hemispherical, attached to a small stone (apparently a manganese nodule); covered with very long, delicate, projecting spicules like a coating of grey hair,[1] with a single, small, oscular (?) projection at the summit. *Diameter* about 8 mm. (excluding the projecting spicules). *Colour* in spirit (after drying) pale, greyish-yellow. *Surface* very strongly hispid. *Osculum* (?) single, at the top of a small, chimney-like projection.

Skeleton.—Composed of great, radiating, divergent brushes of tylostylote spicules. These brushes arise from various levels in the sponge, some from the base and others from nearer to the surface, and their projecting spicules, many of which extend for a millimetre or more beyond the surface of the sponge, give rise to its hairy appearance. Within the sponge itself the space (where such exists) between the radiating brushes of spicules is filled up with a confused mass of shorter tylostylote spicules, which appear to be mixed up together without any pretence of arrangement.

Spicules.—Megasclera (Pl. XLV. figs. 1, 1*a*, 1*b*); of one kind only, but varying much in size. The spicules of the radiating brushes are very long, straight and slender, slightly fusiform, with very well developed oval heads and tapering gradually at the apex to a very fine point (usually broken off). These spicules may reach as much as about 3·0 mm. in length with a diameter of about 0·019 mm. The shorter spicules are much more distinctly fusiform than the longer ones, stouter in proportion to their length, with narrow, constricted neck and almost globular head; they are gradually and finely pointed at the apex and often more or less bent near the neck; length very variable, commonly about 0·5 mm., sometimes less and often more, diameter about 0·015 mm., passing into the larger forms already noticed.

The most interesting points about this sponge are the great size of its spicules and the very great depth (2050 fathoms) from which it was obtained. Unfortunately it was put into a very small bottle with a bad stopper, and, though the bottle was bladdered down, was completely dried up. Although it has no well-marked spicular cortex, yet this

[1] Hence the specific name.

species appears to have a distinct affinity with *Trichostemma;* its small size, general form, and projecting spicules seem to indicate this; for the same reason it stands well apart from other species in its own genus.

Locality.—Station 246, July 2, 1875; lat. 36° 10′ N., long. 178° 0′ E.; North Pacific Ocean; depth, 2050 fathoms; bottom, Globigerina ooze; bottom temperature, 35°·1. One specimen.

Genus *Polymastia*, Bowerbank (Pls. XLI., XLII., XLIV.).

1864. *Polymastia*, Bowerbank, Mon. Brit. Spong., vol. i. p. 177.
1870. (*?*) *Rinalda*, Schmidt, Spong. Atlant. Gebiet., p. 51.
1885. *Weberella*, Vosmaer, Sponges of "Willem Barents" Expedition, 1880–81, p. 16.

Suberitidæ of massive, sessile form, with more or less numerous mammiform processes on the upper surface, some of which may bear oscula at their summits, but usually without visible openings. Skeleton radiately arranged; stout main fibres run vertically to the surface, and there is a cortical layer of smaller spicules arranged vertically to the surface, extending both over the body and the mammiform processes. Megasclera tylostyli or styli. Sponge usually attached and without any supporting fringe of spicules.

Vosmaer (*loc. cit.*) gives the following diagnosis of his genus *Weberella*:—"Massive, globular, very compact. The surface covered with stout, short papillæ. On sections a rind is nearly always distinguished from the mark. Main canals surrounded by compact connective tissue. Canal system of the fourth type. Spicules acuate or pin-shaped." The chief difference from *Polymastia* appears to lie in the shortness of the mammiform processes, but here, as also in *Polymastia*, they are not merely slightly elevated oscula but sometimes closed at the extremities, hence we can see no reason for separating the two genera.

We have some reasons for believing that the genus *Trichostemma* will also ultimately have to be united with *Polymastia*, but further investigation than the time at our disposal will allow of is necessary before taking this step.[1]

The genus *Polymastia* is chiefly confined to deep water, but curiously few representatives of it were obtained by the Challenger.

Polymastia robusta, Bowerbank (Pl. XLI. fig. 8).

1861. *Euplectella robusta*, Bowerbank, List of British Marine Invertebrate Fauna, Rep. of Brit. Assoc. for 1860, p. 236.
1866. *Polymastia robusta*, Bowerbank, Mon. Brit. Spong., vol. ii. p. 62; see also *op. cit.*, vol. iii., pl. x., p. 23, and vol. iv. p. 31.

This species is represented in the collection by a single fine specimen (Pl. XLI. fig. 8) dredged off the south of Nova Scotia; in external appearance the specimen has a

[1] *Cf.* footnote, p. 218.

much closer resemblance to one obtained by the "Porcupine," and now in the British Museum, than to the original type.

Locality.—Station 49, May 20, 1873; lat. 43° 3′ N., long. 63° 39′ W.; south of Halifax, Nova Scotia; depth, 83 fathoms; bottom, gravel, stones; bottom temperature, 35°·0. One specimen.

Habitat.—British Seas (Bowerbank); off Shetland Islands ("Porcupine"); south of Nova Scotia (Challenger).

From the same station (Station 49) there is a second specimen of *Polymastia;* it is small and attached to a stone. It has three small fistulæ and is chiefly remarkable from the presence of a vast number of very long, projecting spicules, which form a deep, velvet-like coat over the body of the sponge. Unfortunately it has been dried up and we cannot be certain of the species to which it belongs; possibly it is *Polymastia mammillaris*,[1] but probably only a young form.

Polymastia corticata, Ridley and Dendy (Pl. XLII. figs. 4, 5, 5*a*, 5*b*, 5*c*; Pl. XLIV. fig. 3).

1886. *Polymastia corticata*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 487.

Sponge (Pl. XLIV. fig. 3) massive, sessile, cushion-shaped; with strongly convex upper surface, bearing very numerous mammiform processes; corticate; consisting of a dense, leathery cortex about 2·5 mm. thick, and an internal, rather friable, dense, amorphous mass of a pale yellow colour, from which the cortex easily separates. The single specimen in the collection is oval in shape, measuring about 87 mm. in length by 62 mm. in width and 37 mm. in thickness. The mammiform processes are of two very different sizes—(1) small, very abundant (there are considerably over one hundred on the single specimen), hollow, elongated, generally flattened and closed at the ends, which are frequently pointed; height about 8 mm., breadth at base 3 mm. (2) Very large, flattened and gradually conical tubes, very few in number (only four or five on the specimen), sometimes open fairly widely at the summit, with a fringe of spicules around the opening, sometimes, however, with no trace of an opening; height about 25 mm., breadth at base a little over 12 mm. In the immediate neighbourhood of the larger processes the smaller ones are scarce or absent. The larger processes, open at the ends, are evidently oscular tubes, each with a single osculum at the summit, while the nature of the small processes is doubtful. The colour of the sponge in spirit is milk-white (this applies to the cortex only, the internal tissues being pale yellow). The surface is smooth but extremely minutely hispid. *Pores* in scattered groups of two or three, each group over a small round or oval subdermal cavity; they seem to occur on every part of the sponge, on both kinds of mammiform processes as well as on the general surface.

[1] *Vide* Bowerbank, Mon. Brit. Spong., vol. ii. p. 71.

Skeleton.—(1) Of the body at large; the outermost portion of the skeleton consists of a dense layer (Pl. XLII. fig. 4, *a*) of thickly set brushes of small, slender, tylostylote spicules, whose points project beyond the surface of the sponge; this layer, the most external layer of the cortical skeleton, is about 0·28 mm. thick;[1] it is immediately succeeded below by a very much thicker layer (Pl. XLII. fig. 4, *b*) of large stylote or subtylostylote spicules, closely and for the most part more or less vertically placed, and with a few small tylostyli amongst them; this layer constitutes the remainder, which is by far the greater portion, of the cortical skeleton. Below the cortex the skeleton is no longer definitely arranged, but consists of a confused mass of thickly scattered spicules, often forming rude fibres. (2) In the mammiform projections there is no such thick cortex as on the main body, they are, comparatively speaking, thin-walled. The outermost layer of the cortical skeleton, consisting of closely packed, small tylostylote spicules, is, however, still present, and below this we find definite longitudinal bands of stout spiculofibre, composed of the large megasclera, and a loose network of similar spicules irregularly disposed.

Spicules.—Megasclera; (1) small, straight or slightly curved, fusiform tylostyli (Pl. XLII. fig. 5*a*), sharply and gradually pointed at the apex and with well developed, pointedly oval heads; size about 0·28 by 0·008 mm. (2) Large, straight, smooth, fusiform styli or subtylostyli (Pl. XLII. figs. 5, 5*b*, 5*c*), tapering very gradually to a sharp point at the apex and narrowing considerably towards the base; size about 0·98 by 0·022 mm.

The species is distinguished from its congeners by its very pure white colour and the very large size and flattened form of the larger mammiform processes.

Locality.—Station 125, September 12, 1873; lat. 10° 46′ S., long. 36° 2′ W.; between Pernambuco and Bahia; depth, 1200 fathoms; bottom, red mud. One specimen.

Polymastia agglutinans, Ridley and Dendy (Pl. XLI. fig. 6; Pl. XLII. figs. 1, 2, 2*a*, 2*b*, 3).

1886. *Polymastia agglutinans*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 488.

Sponge (Pl. XLI. fig. 6) sessile; encrusting and enveloping pebbles, &c., and collecting and cementing on to its own surface numerous fragments of shells, grains of sand, and other foreign objects (whence the specific name), and giving off long, slender, cylindrical, fistular processes, each with a distinct canal up the centre but closed at the top. These processes are quite clean and free from any coating of foreign objects such as covers the body of the sponge. There are two specimens in the collection, the largest of which has a body of irregularly globular form, about 12 to 18 mm. in diameter, and with a great deal of coarse foreign matter inside and adhering to it, quite disguising it

[1] Many of the spicules in this layer are drawn out into long, hair-like points, not shown in the figure.

it bears eight or nine fistulæ, varying from minute buds to processes measuring about 13 mm. in length and about 2 mm. in diameter. The smaller specimen bears only a single long process. *Colour* in spirit (where the surface is visible) almost white. *Texture* of the body, firm, very gritty; of the processes, firm, compact, rather stiff. *Surface* roughened on the body with the foreign objects; smooth and glabrous-looking on the fistular processes, but in reality very minutely hispid. *Oscula* and *Pores* both doubtfully observed, but we have reason to believe, from the examination of our preparations, that numerous small openings in the walls of the fistular processes lead from the outside into the central canal.

Skeleton.—(*a*) Of the main body; as in other species of the genus there are stout columns of spiculo-fibre (Pl. XLII. fig. 1, *c*), running vertically towards the surface, where they expand more or less. The special dermal layer (Pl. XLII. fig. 1, *a*), composed of dense brushes of small stylote spicules, so characteristic of the genus, is almost absent over the body, being replaced functionally by large grains of sand (Pl. XLII. fig. 1, *b*), fragments of shell and so forth; yet it can be found in the crevices between these foreign bodies. The skeleton fibres are composed of large, stout styli or subtylostyli, and in the interspaces between them numerous small tylostyli (Pl. XLII. fig. 1, *d*) are scattered, very abundant near the surface, but rare lower down. (*b*) Of the fistular projections; here the skeleton is very regularly and symmetrically arranged; beginning at the outside there is a very dense dermal crust (Pl. XLII. fig. 3, *a*) of small tylostylote spicules, arranged vertically to the surface, beyond which their apices project for a very short distance. This crust is not quite continuous all over the surface, but arranged in a reticulate manner, so as to leave interspaces in which probably the pores are situate. Immediately beneath this layer comes a layer (Pl. XLII. fig. 3, *b*) of larger spicules, lying parallel (more or less) to the surface and also arranged in a reticulate manner, so as to leave interspaces corresponding to those in the dermal crust. This layer is not very thick and immediately below it comes a series of stout, longitudinal bands of spiculo-fibre (Pl. XLII. fig. 3, *c*), about ten or twelve in number, and arranged in a circle against its inner surface, like a series of buttresses against the inside of a wall; then come the soft tissues, almost devoid of spicules excepting immediately around the central canal, where small tylostyli are sometimes abundantly scattered (Pl. XLII. fig. 3, *d*). The structure of the stout fibres in the fistular processes appears to be exactly the same as in the body of the sponge.

Spicules.—Megasclera; (1) large, straight styli or subtylostyli (Pl. XLII. fig. 2), very gradually and finely pointed at the apex and narrowing somewhat towards the base; size up to about 1·2 by 0·0157 mm. (2) Very small, usually slightly curved, slender tylostyli (Pl. XLII. figs. 2*a*, 2*b*), with well-developed heads and fairly sharp apices; size about 0·175 by 0·004 mm. More or less intermediate forms also occur, *e.g.*, in the layer beneath the dermal crust, but the two chief forms are very distinct from one another,

the one being found mainly in the dermal crust and scattered through the soft tissues, and the other in the stout fibres.

This is a very pretty and interesting little species; it seems to be perfectly distinct from all previously known, and its habit of agglutinating comparatively large foreign objects on to the surface of the body is very peculiar, although other species may acquire an accumulation of minute particles of dirt. One function of this crust is possibly to conceal the sponge from its enemies.

The skeleton arrangement in the fistular processes calls to mind the corresponding arrangement in *Proteleia sollasi*, but there is only a single, though more regular circle of fibres (*cf.* figs. 3 and 7, Pl. XLII.). The number of these fibres appears to be inconstant.

Locality.—Station 75, July 2, 1873; lat. 38° 38′ 0″ N., long. 28° 28′ 30″ W.; off the Azores; depth, 450 fathoms; bottom, volcanic mud. Two specimens.

Genus *Proteleia*, Dendy and Ridley (Pls. XLII. XLIV.).

1886. *Proteleia*, Dendy and Ridley, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 152.

Sponge sessile, corticate; upper surface covered with mammiform processes. Megasclera tylostylote and (or) stylote; and also spicules with grapnel-like apices projecting freely beyond the surface of the sponge.

This is one of the most interesting of the new genera which we have been obliged to found. It comes very close to *Polymastia* but differs from that genus in the possession of the grapnel-like spicule. This feature seems to approximate it to the Tetractinellida, but this question has been fully discussed by us elsewhere (*vide* Ann. and Mag. Nat. Hist., *loc. cit.*).

Proteleia sollasi, Dendy and Ridley (Pl. XLII. figs. 6, 7, 8, 8*a*, 8*b*, 8*c*, 8*d*, 8*e*, 8*f*, 8*g*, 8*h*; Pl. XLIV. fig. 2).

1886. *Proteleia Sollasi*, Dendy and Ridley, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 153, pl. v.

Sponge (Pl. XLIV. fig. 2) sessile, apparently coating, consisting of a flattened, cake-like expansion with slightly convex upper surface, from which arise abruptly numerous short, thick, cylindrical, mammiform projections of various sizes. The single specimen in the collection is about 63 mm. long by 31 mm. broad, and about 13 mm. thick. The mammiform processes vary somewhat in size, being, when full grown, about 8 mm. long by 4 mm. in diameter at the base; they are almost solid and very stiff and firm, contrasting strongly with those of *Polymastia robusta* and *Polymastia mammillaris* in this respect, at present they are all closed at the summit, and

it is doubtful whether or no any opening exists in the living sponge, though traces of what appears to be such can be found. *Colour* in spirit yellowish-grey. *Texture* tough and leathery, internally coarsely fibrous; the cortex is very firmly adherent to the underlying tissues. *Surface* between and on the mammiform processes even, seen in sections to be minutely hispid; the hispidity is more strongly marked over the body than on the mammiform processes; on the body there is a considerable amount of foreign matter collected, while the mammiform processes are free from it and almost glabrous in appearance. *Oscula* (? minute, at the summits of the papillæ). *Pores* scattered (? singly) over the surface of the body and of the mammiform processes.

Skeleton.—(*a*) Of the main body (1) a thin, very dense and compact external layer (Pl. XLII. fig. 6, *b*), about 0·15 mm. thick, composed of vertically placed, tightly packed, small, straight and slender tylostylote spicules, with their apices directed outwards and projecting for a short distance beyond the surface of the sponge. (2) Immediately below the above and inseparable from it a similar but very much thicker layer (Pl. XLII. fig. 6, *c*) of larger, stout tylostylote spicules, arranged as in the first layer and with their apices embedded in it, thickness about 0·35 mm. These two layers may be considered as cortical. Besides the spicules already mentioned, there are in the cortex spicules of another and very remarkable kind, the grapnel-spicules (Pl. XLII. fig. 6, *d*) to be described later. These have the base and part of the shaft embedded in the cortex while the remainder of the spicule projects freely for a considerable distance beyond the surface of the sponge, and bears at its extremity the grapnel. Immediately below the cortex, as above defined, comes a layer (Pl. XLII. fig. 6) about as thick as the second cortical layer, of still larger, stout tylostylote spicules, not vertically disposed but for the most part horizontally and irregularly, forming a compact mass. Below this layer comes the general parenchyma of the sponge (choanosome), with very numerous scattered tylostylote spicules, and with very well defined, stout fibres (Pl. XLII. fig. 6, *a*), composed of large stylote or subtylostylote spicules longitudinally placed and with their apices outwardly directed. These primary fibres run vertically towards the surface of the sponge; before arriving there they expand into divergent brushes of large spicules whose apices penetrate right into or even through the cortex. Secondary skeleton fibres, if present at all, are very ill defined. (*b*) The skeleton of the mammiform processes (Pl. XLII. fig. 7); the cortex and the layer immediately below it are arranged very much as in the main body, except with regard to the grapnel-spicules, which seem to be entirely absent; then come very definite, stout, longitudinally placed bundles of spiculofibre (Pl. XLII. fig. 7, *a*), like those of the main body and arranged mainly, and fairly regularly, in two concentric circles, and with the spaces between them filled with a great number of irregularly but closely arranged tylostylote spicules; in the centre of the inner circle of fibre bundles is a space almost quite free from spicules and filled with a yellow, granular substance.

Spicules.—Megasclera; (1) small, slender, very slightly curved, sharply and gradually pointed tylostyli (Pl. XLII. figs. 8*g*, 8*h*) with not very well-developed oval heads, size about 0·16 by 0·0045 mm.; these spicules occur in the outermost layer of the cortex. (2) Much larger, very stout, sharply pointed, fusiform tylostyli (Pl. XLII. figs. 8*e*, 8*f*), with roundish heads; size variable, about 0·22 by 0·0189 mm.; occurring in the lower cortical layer and passing gradually by spicules intermediate in form and size into (3) the long styli (Pl. XLII. fig. 8) of the fibres; these are smooth, straight, fusiform and sharply and gradually pointed at the apex; size about 1·2 by 0·03 mm. (4) The grapnel spicules (Pl. XLII. figs. 8*b*, 8*c*, 8*d*); long, very slender, with more or less expanded base and tapering very gradually to hair-like fineness towards the apex, ending finally in a small knob provided with recurved teeth which do not seem to be quite constant in number; commonly there are about four teeth, but owing to the minute size it is not easy to make out details; sometimes the teeth are absent, leaving only the knob. Length of spicule about 0·52 mm., thickness at thickest part of shaft about 0·0063 mm.

Locality.—Simon's Bay, Cape of Good Hope; depth, 10 to 20 fathoms. One specimen.

Genus *Trichostemma*, M. Sars (Pl. XLIII.).

1872. *Trichostemma*, M. Sars, Remarkable Forms of Animal Life, pt. i. p. 62.[1]
1870. *Radiella*, Schmidt, Spong. Atlant. Gebiet., p. 48 (not *Radiella*, Sollas, Ann. and Mag. Nat. Hist., ser. 5, vol. ix. p. 162).

Sponge free living, with definite, symmetrical, external form; discoid or hemispherical; with a marginal fringe of long, hair-like spicules serving to maintain the sponge in its position in the mud. Oscula, one or more at the ends of short oscular tubes on the upper surface. Megasclera mainly tylostylote.

The original diagnosis (*loc. cit.*, p. 65) runs :—" Spongia silicea, simplex, libera, in limo demersa et hic fimbria spiculorum setiformium, flexibilium, radiantium sustentata, cortice crasso compacto circumdata, interiore multo minus compacto, parenchymatoso, lacunis numerosis irregularibus trajecto. Oscula numerosa tubiformia in facie superiore libere prominentia. Sceletum ex spiculis acuformibus fasciculato-radiantibus compositum, aliis brevissimis capite globoso in cortice densissime accumulatis, aliis multo longioribus, fasciculos tenues parenchyma et corticem trajicientes formantibus."

The original type of the genus is *Trichostemma hemisphæricum*, Sars, which " occurs not rarely at Lofoten . . . . in a depth of 120–300 fathoms on soft clay bottom." The Challenger adds two new species, both from a very great depth and a bottom of ooze or mud. It is essentially a deep-sea genus, and forms another example of the manner in which deep-sea sponges commonly assume a definite, symmetrical external form; in this

[1] The genus and species are first described in this place as *nov. gen. et spec.*, but the name is used by Sars so far back as 1869 (*Forhandl. Vidensk. Selsk. Christiania*, 1869, p. 250), without, however, any description.

case, however, the object of the flattened form and the long radiating spicules is obvious, namely, as pointed out by Sars, to support the animal in the soft mud on which it lies; in our new species, *Trichostemma sarsii*, this arrangement is brought to a much greater degree of perfection than in the original type of the genus (*vide* Pl. XLIII. figs. 1, 1*a*, 2, 2*a*, 3, 3*a*, and woodcut, Fig. 8).

The genus has a very wide geographical range, being found in deep water off the north of Scotland (Carter), off the coast of Norway (Sars, Hansen), Gulf of St. Lawrence (Whiteaves), off the Azores (Challenger), off the north-east coast of Australia (Challenger), off the west coast of South America (Challenger), and in the Arctic Sea (Vosmaer).

The question as to whether Schmidt's genus *Radiella* is really the same as *Trichostemma* is a very difficult one. His generic diagnosis is not very recognisable; it runs as follows:—"Suberiten mit radiärer Schichtung der Nadeln; ohne Wurzeln und ohne wahre Rinde, d. h. ohne Rinde mit Faserelementen. Oscula vorhanden."[1] The type of his genus, *Radiella sol*, is undoubtedly extremely like our *Trichostemma sarsii*, and the fact of its being also found in deep water (Cuba, 638 fathoms) perhaps strengthens the

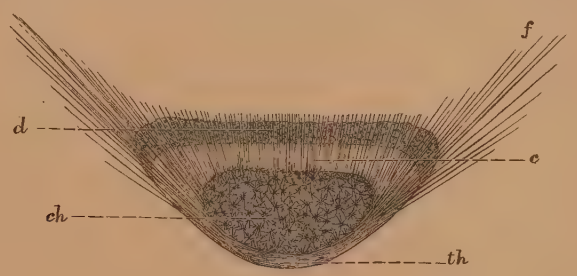


FIG. 8.—*Trichostemma sarsii*. Vertical section, showing the arrangement of the skeleton; *f*, fringe of long, projecting spicules; *c*, cortical layer of vertical spicules; *d*, external layer of foreign objects, dirt, &c.; *ch*, choanosome, containing stellate groups of spicules; *th*, "thatch" of spicules on the lower surface of the sponge. × 5.

probability of their being closely allied. According to Schmidt's figure[2] the external form of the sponge is almost identical with that of *Trichostemma sarsii*, but judging by his description and figure there is no superior cortical layer and no internal confused mass of spicules, the smaller spicules instead running continuously from the lower to the upper surface of the sponge, beyond which they project "unmerklich." The thatch-like coat of radiating spicules on the lower surface of the sponge seems to be the same as in *Trichostemma sarsii*. In form also the spicules of the two species seem to be about the same, but Schmidt gives no measurements.

On the other hand Hansen[3] states that he has examined an original specimen of *Radiella sol* and identifies it with *Trichostemma hemisphæricum*.

Considering, therefore, that the name *Trichostemma* was used by Sars so far back as

[1] Spong. Atlant. Gebiet., p. 48.
[2] *Loc. cit.*, pl. iv. fig. 6.
[3] Norwegian North-Atlantic Expedition; Spongiadæ, p. 7.

1869 (*loc. cit.*), though his generic diagnosis does not appear till 1872, and that Schmidt's diagnosis of the genus *Radiella* is highly unsatisfactory, we think ourselves fully justified in retaining Sars' generic name, although the two seem to be probably synonymous. Upon this latter point, however, we should be very doubtful were it not for Hansen's precise statement, for the absence of the upper cortical layer of spicules in *Radiella* would be a very strong point.

Another sponge with almost identical external form is Bowerbank's *Halicnemia patera*,[1] but the genus *Halicnemia* is at once differentiated from *Trichostemma* by the presence of peculiar spicules in the dermal membrane, which Bowerbank tells us are "very numerous, dispersed, fusiformi-acerate, entirely spined, subangulated, and frequently inflated at the middle."

Probably the peculiar external form of these sponges is comparable to the "*Crinorhiza*" form found amongst the Desmacidonidæ, and may exist in very different genera when living under similar conditions; another instance being the little known *Xenospongia patelliformis*, Gray, which only wants the marginal spicular fringe to complete the external resemblance, but has a totally distinct spiculation (including stellate forms).[2]

Trichostemma sarsii, Ridley and Dendy (Pl. XLIII. figs. 1, 1*a*, 2, 2*a*, 3, 3*a*).

1886. *Trichostemma Sarsii*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 488.

Sponge (Pl. XLIII. figs. 1, 1*a*, 2, 2*a*, 3, 3*a*,) discoid, much flattened and usually thin. Flattened more especially on one side, which bears an oscular tube in its centre, and must therefore be regarded as the upper one. The lower side appears to be always more or less convex but usually only slightly so; in the single specimen from Station 184, however, it is strongly convex. The margin of the disk is thin, and provided with a beautiful fringe of very long, silky-looking spicules. The largest specimen is about 13 mm. in diameter (exclusive of the fringe of spicules, which is 3 mm. broad), and only just over 3 mm. in thickness at the centre. The smallest specimen has a diameter of about 5 mm. (exclusive of the fringe of spicules, which is again about 3 mm. broad). The diameter of the Australian specimen is about 8 mm. (excluding fringe), and the thickness in the centre 4 mm. On holding a specimen up to the light and looking at the flat side one sees a number of small, round, translucent patches, about 1·5 mm. in diameter, and arranged for the most part in a circle, a short distance within the margin of the sponge (*cf.* Pl. XLIII. fig. 2, &c.). The nature of these is very doubtful; we were at first inclined to regard them as pore-areas, but there is hardly sufficient evidence to

[1] Mon. Brit. Spong., vol. i. p. 184, pl. x. figs. 228–233, pl. xxxii. figs. 363, 364; vol. ii. p. 96; vol. iii., pl. xv. figs. 31, 32; vol. iv. p. 45.

[2] Concerning the relations of *Trichostemma* to *Polymastia* we prefer at present to keep silence. Vosmaer, however (Sponges of the "Willem Barents" Expedition 1880–81, p. 12), makes the two genera identical, but, though there is much to be said in favour of this view, we are, as already indicated, not yet satisfied about the matter. We cannot, however, at all understand how Vosmaer (*loc. cit.*) has come to the conclusion "that there is no generic difference between *Halicnemia* and *Polymastia*," and also, of course, *Trichostemma*, in spite of the differences in spiculation; a conclusion at which also von Marenzeller had previously arrived (*Denkschr. d. k. Akad. Wiss. Wien*, Bd. xxxv. p. 371).

support this view. *Colour* in spirit greyish-yellow. *Texture* firm. *Surface* fairly even. *Oscula;* one (? sometimes more) at the top of an oscular tube in the centre of the flat surface. *Pores* (?).

Skeleton.—The convex (lower) surface of the sponge is covered with a dense thatch (*vide* woodcut, Fig. 8, *th*), of very long tylostylote or subtylostylote spicules, which, radiating outwards and upwards from the centre, form, round the margin of the sponge, the spicular fringe already mentioned. On the flat (upper) surface there is no such thatch, but there is a thick ectosome (woodcut, Fig. 8, *c*) packed with tylostylote spicules, which are for the most part vertically arranged. On the outside of this ectosome is collected a thick stratum of foreign matter (woodcut, Fig. 8, *d*), through which the apices of the tylostylote spicules often project for a short distance. Below the ectosome come the softer tissues of the sponge (choanosome, *vide* woodcut, Fig. 8, *ch*), which are crowded with vast numbers of closely packed, much shorter, tylostylote spicules; these have no very definite order except that they exhibit a tendency to an arrangement in thick, radiating groups with the globular heads in the centre.

Spicules.—Megasclera; (1) the exceedingly long, straight, slender, tylostylote or subtylostylote spicules forming the thatch and fringe. It is not easy to give the maximum length of these, owing to the manner in which they break on attempting to separate them for purposes of measurement, but we have found examples about 4·7 mm. long, and this seems to be no uncommon size; their diameter is commonly about 0·02 mm.; the heads are generally subglobular and not very strongly developed, and at the apex the spicule tapers very gradually to excessive fineness. (2) The spicules of the choanosome; these are short, straight, stout, fusiform tylostyli, sharply pointed at the apex and with very well developed, globular heads; size about 0·3 by 0·016 mm. (In the Australian specimen they are shorter than this.) (3) The spicules of the ectosome; these are also tylostylote or subtylostylote and are intermediate in size between the two forms above described.

This species differs markedly enough in external form alone from the original type of the genus, *Trichostemma hemisphæricum*, Sars,[1] to be distinguished at a glance, for Sars' species is very much larger, strongly hemispherical, and has the convex surface uppermost, and provided, in the adult, with many oscula; while the fringe of spicules slopes downwards, *i.e.*, away from the osculum-bearing surface. The differences between *Trichostemma sarsii* and *Trichostemma irregularis* are indicated at the end of the description of the latter species.

The geographical distribution of *Trichostemma sarsii* is a very interesting one; it seems to be confined to very deep water, and was met with off the Azores and in Australian seas, thus giving a very wide range. There are, it is true, certain slight differences between the specimens from the two localities, which have been indicated in the description, but there is nothing to justify us in separating them specifically.

[1] Remarkable Forms of Animal Life, pt. i. p. 62.

Localities.—Station 73, June 30, 1873; lat. 38° 30′ N., long. 31° 14′ W.; off the Azores; depth, 1000 fathoms; bottom, Pteropod ooze; bottom temperature, 39°·4. Five specimens.

Station 184, August 29, 1874; lat. 12° 8′ S., long. 145° 10′ E.; south-east of Cape York; depth, 1400 fathoms; bottom, Globigerina ooze; bottom temperature, 36°·0. One specimen.

Trichostemma irregularis, Ridley and Dendy (Pl. XLIII. figs. 4, 4*a*, 5).

1886. *Trichostemma irregularis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 489.

There are in the collection two specimens of this species which differ considerably from one another in external appearance. The one (Pl. XLIII. figs. 4, 4*a*), which is probably the normal form, has its parts arranged very much as in *Trichostemma sarsii*. In shape it closely resembles an inverted mushroom without the stalk. The convex, lower surface is protected by a thatch-like covering of very large spicules, which radiate upwards and outwards from its centre, and form a thick, irregular fringe round the free margin. The upper surface is slightly concave, strongly hispid, and bears a considerable accumulation of foreign dirt. It also bears a few, irregularly scattered, small, papilliform processes which may be oscular tubes. The specimen is about 17 mm. in diameter and 8·5 mm. thick in the centre. (The second specimen (Pl. XLIII. fig. 5) appears to be abnormal in shape; it is of about the same size as the first, but the upper surface is strongly convex and the lower slightly concave, and the long, projecting spicules are also very irregularly arranged, projecting almost at right angles all over the lower surface.) *Colour* in spirit dirty yellow. *Texture* fairly firm but rather spongy. *Lower surface*, in normal specimen, radiately fibrous, *upper surface* strongly hispid. *Oscula* (? several, on the upper surface, on the summits of papilliform projections).

Skeleton.—Normally arranged as in *Trichostemma sarsii;* the projecting spicules of the ectosome, on the upper surface, however, project for a very much greater distance than in that species, the portions outside the sponge being long and of hair-like fineness, sometimes even flexuous.

Spicules.—Megasclera; all either tylostylote or subtylostylote, but of most variable length; the spicules of the ectosome and of the interior of the sponge are much larger and slenderer than in *Trichostemma sarsii;* the former often projecting for as much as 1 mm. beyond the surface, while the latter commonly measure about 0·5 by 0·012 mm., but are often much larger. The large external spicules seem to be of about the same size as in *Trichostemma sarsii;* their heads are very feebly developed.

In appearance this species is very much clumsier and coarser than the foregoing, the upper cortical and internal spicules are larger, and there seems to be more than one osculum.

Locality.—Station 299, December 14, 1875; lat. 33° 31′ S., long. 74° 43′ W.; west of Valparaiso; depth, 2160 fathoms; bottom, blue mud; bottom temperature, 35°·2. Two specimens.

Genus *Tentorium*, Vosmaer.

1870. *Thecophora*, Schmidt, Spong. Atlant. Gebiet., p. 50.
1885. *Tentorium*, Vosmaer, Bronn's Klass. u. Ordn. d. Thierreichs, Porifera, p. 329.

Sponge sessile, columnar or conical; protected by a dense, cylindrical sheath of longitudinally placed spicules, which form a solid, imperforate layer. Over the top there is a proper fibrous cortex containing bundles of smaller spicules arranged vertically to the surface, between which are situate the large, elongated subdermal cavities. Pores on the upper surface only. Oscula tubular, in the centre of the upper surface; commonly only one. Spicules tylostylote or subtylostylote.

Schmidt gives no generic diagnosis, but Vosmaer, in addition to pointing out that the name *Thecophora* is already occupied, gives the following:—"Cylindrischer mit breiter Basis angewachsener Körper. Oben sind kleine papillenartige Oscula. Rinde besonders deutlich oben. Spic. indic. *tr° ac. f.* von verschiedener Grösse."

Only a single species of the genus is as yet established.

Tentorium semisuberites, Schmidt, sp.

1870. *Thecophora semisuberites*, Schmidt, Spong. Atlant. Gebiet., p. 50, pl. vi. fig. 2.
1873. *Thecophora ibla*, Wyville Thomson, Depths of the Sea, p. 147, fig. 24.
1877. *Thecophora elongata*, von Marenzeller, Die Cœlenteraten, Echinodermen und Würmer der K. K. Österreichisch-ungarischen Nordpol-Expedition, p. 12, pl. ii. fig. 4.
1885. *Tentorium semisuberites*, Vosmaer, Bronn's Klass. u. Ordn. d. Thierreichs, Porifera, p. 329, pl. ii. fig. 4; pl. xxi. fig. 19.

This very interesting and well-characterised sponge is represented in the collection by a fine series of ten specimens from Station 49, and a single very fine specimen, attached to a stone, from Station 50. There are also four specimens, much smaller than usual and characterised by correspondingly smaller spicules, from Inaccessible Island, which we propose to consider as belonging to a dwarf variety, although the possibility of their being young forms must be borne in mind. Hansen[1] has already given *Thecophora ibla* and *Thecophora elongata* as synonyms of the original *Tentorium semisuberites* and we are quite prepared to follow him in this. The difference between the three forms depends very largely on the degree of contraction of the specimen; when the specimen is in an expanded condition, the top appears evenly rounded, as in Schmidt's original figure and

[1] The Norwegian North-Atlantic Expedition, 1876–1878, Spongiadæ, p. 8.

in fig. 23 (*Thecophora semisuberites*) of the Depths of the Sea; when, on the other hand, the animal is contracted, the top of the sponge, owing to the arrangement of the brushes of spicules immediately below the surface, becomes uneven and "scaly" in appearance as in fig. 24 (*Thecophora ibla*) of the Depths of the Sea. Evidently, when living, the sponge possesses great power of contractility, a power which would appear to be shared in large measure by the oscular tube.

Vosmaer, in his Report on the Sponges of the "Willem Barents" Expedition of 1880 and 1881 (p. 18), has given some account of the minute anatomy of this species, and some observations on this subject are also given in the Introduction to the present work.

Localities.—Station 49, May 20, 1873; lat. 43° 3′ N., long. 63° 39′ W.; south of Nova Scotia; depth, 85 fathoms; bottom, gravel, stones; bottom temperature, 35°·0. Ten specimens.

Station 50, May 21, 1873; lat. 42° 8′ N., long. 63° 39′ W.; south of Nova Scotia; depth, 1250 fathoms; bottom, blue mud; bottom temperature, 38°·0. One specimen.

Inaccessible Island, October 16, 1873; depth, 60 to 90 fathoms. Four small specimens of a dwarf variety.

Habitat.—Arctic Seas (Schmidt, Vosmaer, &c.); North Atlantic (Carter, &c.); Gulf of St. Lawrence (Whiteaves); Newfoundland (Smith and Harger); off Nova Scotia (Challenger); Inaccessible Island (Challenger).

Genus *Stylocordyla*, Wyville Thomson (Pl. XLIII.).

1869. *Hyalonema* (*pars*), Lovén, Öfversigt k. Vetensk.-Akad. Förhandl., vol. xxv. p. 119.
1873. *Stylocordyla*, Wyville Thomson, The Depths of the Sea, p. 113.
1876. *Polymastia* (*pars*), Carter, Ann. and Mag. Nat. Hist., ser. 4, vol. xviii. p. 393.
1880. *Stylorhiza*, Schmidt, Spong. Meerb. von Mexico, pt. ii. p. 79; pl. x. fig. 5.
1881. (?) *Rhizaxinella*, Keller, Arch. Micr. Anat., vol. xviii. p. 271.

Sponge corticate, differentiated into distinct head and stalk. Skeleton in head radiately arranged, with a cortical layer of smaller spicules set vertically to the surface; skeleton in stalk consisting chiefly of a dense axis of longitudinally arranged spicules. Spicules oxeote only.

This genus still stands aloof from all other Suberitidæ in its remarkable spiculation, though, as regards external form, the old distinction embodied in the term *Stylocordyla* no longer holds good, for similar stipitate forms are found to occur in the genus *Suberites* (*e.g.*, *Suberites ramulosus*, nobis).

Only one species of the genus is as yet established satisfactorily (see synonyms and references below).

Stylocordyla stipitata, Carter, sp. (Pl. XLIII. figs. 6, 7, 8, 9).

1873. *Stylocordyla borealis*,[1] Wyville Thomson, The Depths of the Sea, p. 113, fig. 13.
1876. *Polymastia stipitata*, Carter, Ann. and Mag. Nat. Hist., November 1876, p. 393.
1880. *Stylorhiza stipitata*, Schmidt, Spong. Meerb. von Mexico, pt. ii. p. 79, pl. x. fig. 5.
(See also Vosmaer, The Sponges of the "Willem Barents" Expedition, 1880 and 1881, p. 11.)[2]

There are three small specimens (Pl. XLIII. figs. 7, 8, 9) of this sponge from Station 147, one (Pl. XLIII. fig. 6) from Station 49, and one from off Bahia; two of the specimens have oval heads only about 4 mm. in longest diameter, while the two largest specimens have heads more of the typical shape, as described by Carter for adult specimens; even the latter are, however, very small as compared with Carter's types in the British Museum, the largest head (from Station 147) being only about 11 mm. long by about 4 mm. in diameter at the widest part, where there is a whorl of projecting spicules.

The external form of this sponge is very variable. Schulze,[3] as well as Carter,[4] has already noticed that the head in young forms is more or less round; we have to notice below a variety in which the head is globular even in the adult. We have detected no important difference in spiculation between Mr. Carter's types and the Challenger specimens.

It appears to us highly probable that Lovén's *Hyalonema boreale*[5] is really the same species as Carter's *Polymastia stipitata*, in spite of the fact that the larger oxeote spicules in the former sponge are described as having a central inflation, a character which may perhaps be considered as abnormal, for Lovén had only two specimens for examination. Still we are not as yet convinced of this identity.

The geographical distribution of this sponge is a very wide and remarkable one, as will be seen by the list of localities below, and its bathymetrical range is no less extraordinary.

Localities.—Station 49, May 20, 1873; lat. 43° 3′ N., long. 63° 39′ W.; south of Halifax, Nova Scotia; depth, 85 fathoms; bottom, gravel, stones; bottom temperature, 35°·0. One specimen.

Station 147, December 30, 1873; lat. 46° 16′ S., long. 48° 27′ E.; between Marion and Crozet Islands; depth, 1600 fathoms; bottom, Diatom ooze; bottom temperature, 34°·2. Three specimens.

Off Bahia; depth, 7 to 20 fathoms. One very small specimen with nearly globular head.

[1] Lovén's species (*vide infra*) with which Sir Wyville Thomson identified Carter's *Polymastia stipitata*.

[2] As we are not convinced of the correctness of Vosmaer's views as to the synonymy of this species as here given, we prefer to make use of the specific name given by Mr. Carter, with whose types we identify our specimens.

[3] Exploration of the Faröe Channel, p. 71, *Proc. Roy. Soc. Edin.*, 1881–1882.

[4] *Loc. cit.*, p. 393.

[5] *Öfversigt k. Vetensk.-Akad. Förhandl.*, 1868 (pub. 1869) p. 105, pl. ii., see also translation of this paper in *Ann. and Mag. Nat. Hist.*, ser. 4, vol. ii. p. 81, pl. vi.

Habitat.—Between north of Scotland and Faröe Islands (Carter, Schulze); Grenada (Schmidt); Southern Ocean (Challenger); south of Nova Scotia (Challenger); Bahia (Challenger).

Stylocordyla stipitata, var. *globosa*, Ridley and Dendy (Pl. XLIII. fig. 10).

1886. *Stylocordyla stipitata*, var. *globosa*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 489.

We unite under the above name a large series of specimens from Kerguelen Island and three small ones from Station 145. This variety is distinguished from the types of

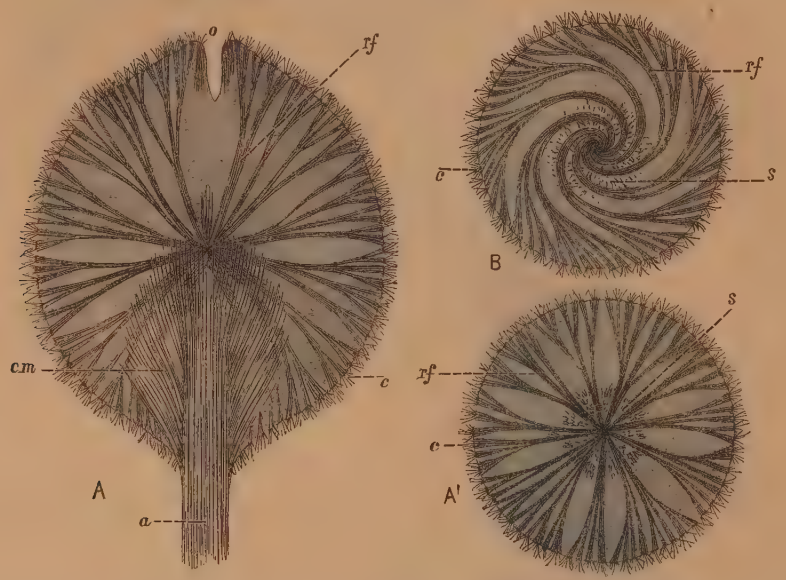


Fig. 9.—*Stylocordyla stipitata*, var. *globosa*. Sections showing the arrangement of the skeleton. A, longitudinal section of a specimen which exhibits no spiral arrangement of the fibres, × 6. A′, transverse section of do., × 4. B, transverse section of a specimen in which the fibres are spirally disposed, × 4; *o*, osculum; *c*, cortical spicules; *a*, stem; *cm*, central mass of spicules derived from the breaking up of the stem; *s*, sections of do.; *rf*, the radiating skeletal fibres.

the species by the almost perfectly globular, bullet-like head of the adult sponge (Pl. XLIII. fig. 10), which, though it may become slightly oval, never exhibits the truncated appearance shown by adult specimens of the typical form, and never possesses a whorl of projecting spicules below the osculum, the entire surface of the head being evenly and minutely hispid. The stem also is not nearly so thick and fleshy-looking as in Carter's larger specimens, and has not nearly so large a conical basal expansion; as in the types, there are a number of fine attaching rootlets. We know of no characters by which it would be possible to distinguish the young forms of the variety from those of the species proper.

The remarkable spiral arrangement of the skeleton in the head of this sponge has

already been noted by earlier authors. It is extremely well shown in the present variety, and we have thought it desirable to give a woodcut illustrative of it (*vide* woodcut, Fig. 9, B). This has been executed for us by Mr. Highley with his usual skill and accuracy, and renders further description unnecessary. It is, however, important to notice that in one of the specimens examined by us the skeleton was simply radiate, without any spiral twist at all; this is also shown in the figure (Fig. 9, A, A′) contrasting strongly with the normal spiral arrangement. We must also note that this particular specimen contained large quantities of embryos in various stages of development; it is just possible that these two facts may be correlated, but it is very difficult to see how.

There are in the collection no less than fifty-three specimens which we refer to this variety; they vary much in size; the largest has a stem 75 mm. long, surmounted by a head about 17 mm. in diameter. We have never found more than a single osculum, which is situated at the top of the head. The specimens are in an excellent state of preservation and details as to their minute anatomy and histology will be found in the Introduction.

Neither in specimens of the species proper nor yet of the variety have we detected any branching of the stem, and this character, as well as those of the spiculation, &c., distinguishes *Stylocordyla stipitata*, Carter, from *Suberites ramulosa*, nobis, which somewhat resembles it in external form.

Localities.—Station 145, December 27, 1873; lat. 46° 43′ 0″ S., long. 38° 4′ 30″ E.; depth, 140 fathoms; bottom, volcanic sand. Three small specimens.

Off Kerguelen; depth, 10 to 100 fathoms. Fifty specimens.

Genus *Quasillina*, Norman.

1869. *Quasillina*, Norman, Last Report on Dredging among the Shetland Isles, Brit. Assoc. Rep. for 1868, p. 329.
1875. *Bursalina*, Schmidt, Jahresb. d. Comm. wiss. Untersuch. d. deutsch. Meere, Jahrg. ii., iii. p. 116.

Sponge corticate, stipitate, with oval body, bearing a single osculum at the summit, and short stalk. In the cortex primary skeleton fibres ascend in parallel lines from the base, crossed at right angles by secondary ones. Spicules, large and small styli.

Dr. Norman's diagnosis runs as follows:—"Sponge consisting of a single clavate hollow body, widening upwards from the base, and rising at once from the surface of the stone to which it is attached, without any expanded basal mass. Skeleton beautifully reticulate, primary fasciculi ascending in parallel straight lines from the base, and in diverging, radiating lines from a central mammæform projection at the summit of the sponge; secondary fasciculi at right angles to the primary ones. Spicula fusiformi-acuate."

We cannot agree with Bowerbank in placing the species *Quasillina brevis* in the genus *Polymastia*; it appears to us to differ from it very widely, and Dr. Norman has done good service in erecting a new genus for its reception. Schmidt cannot have been aware of

the existence of Norman's genus when, in 1875, he founded his genus *Bursalina* for a species which appears to be identical with *Quasillina brevis;* he does not venture upon a generic diagnosis, and, unfortunately, gives no spicular measurements.

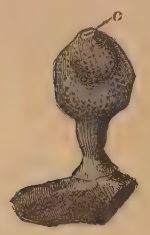


Fig. 10.—*Quasillina brevis*, attached to a stone, showing the osculum, *o*. Nat. size.

Vosmaer[1] has given a discussion of the genus and species, and has also given some description of the minute anatomy. His specimens seem to have been in much better condition than the Challenger ones. There can be no doubt that the body is not hollow in life, but the soft internal tissues generally shrink up and disappear, or liquefy and run off, after the death of the animal, thus giving to the sponge its characteristically hollow form.

The common existence of a single osculum at the summit of the sponge (*vide* woodcut, Fig. 10, *o*), a point of considerable interest, is demonstrated by the Challenger specimens. (Vosmaer states that he "never saw an opening on the top larger than those where the sea-water enters," but there can be no doubt that in life there is always an osculum at the summit of the body.)

Quasillina brevis, Bowerbank, sp.

1861. *Euplectella brevis*, Bowerbank, List Brit. Marine Invert. Fauna (Brit. Assoc.), p. 71.
1864. ? *Polymastia robusta*, Bowerbank, Mon. Brit. Spong., vol. i. pp. 178, 285, pl. xxix. fig. 358.[2]
1866. *Polymastia brevis*, Bowerbank, Mon. Brit. Spong., vol. ii. p. 64 (see also vol. iii. p. 25, pl. xi. figs. 1–9 and vol. iv. p. 31).
1869. *Quasillina brevis*, Norman, Last Rept. Dredg. Shetland Isles (Brit. Assoc. Rep. for 1868), p. 329.
1875. *Bursalina muta*, Schmidt, Jahresb. d. Comm. wiss. Untersuch. d. deutsch. Meere, Jahrg. ii., iii. p. 116.

The Challenger obtained fourteen specimens of this very remarkable sponge, nearly all attached to pebbles by a stem or peduncle, and all from Station 49. Many of the specimens have a single small osculum at the summit (*vide* woodcut, Fig. 10, *o*); all appear to be hollow, containing in the large internal cavity more or less of a yellow amorphous substance caked on to the body-walls. The spicules are, as usual, large and small styli, the former measuring about 1·1 by 0·02 mm. and the latter about 0·28 by 0·01 mm.; they agree very fairly with those of Bowerbank's species, as shown by his preparations in the British Museum.

It is doubtful whether the sponge described and figured by Schmidt[3] from the Gulf

[1] Sponges of the "Willem Barents" Expedition, 1880 and 1881, p. 20.

[2] There has evidently been some mistake here, we give this synonym because fig. 358, pl. xxix. vol. i. of Bowerbank's Mon. Brit. Spong. is described in the first volume (pp. 178, 285) as *Polymastia robusta*, but is referred to in the third (p. 25) and fourth (p. 31) volumes as *Polymastia brevis*.

[3] Spong. Meerb. von Mexico, p. 79, pl. x. fig. 4.

of Mexico, under the name *Bursalina muta*, var., is really *Quasillina* at all; the external form, as figured by him, is somewhat different, and he has not determined, apparently through fear of injuring the specimen, whether a large central cavity is present or not; this being, though only a post-mortem condition, very characteristic of the species. The species appears to be widely distributed and not uncommon, especially in northern latitudes.

Locality.—Station 49, May 20, 1873; lat. 43° 3′ N., long. 63° 39′ W.; south of Halifax, Nova Scotia; depth, 85 fathoms; bottom, gravel, stones; bottom temperature, 35°·0. Fourteen specimens.

Habitat.—Shetland (Bowerbank, &c.); south-west coast of Norway (Schmidt); south of Nova Scotia (Challenger); ?Gulf of Mexico (Schmidt); Mediterranean, off Benzert, North Africa (specimens in British Museum); Arctic Ocean (Vosmaer).

Genus *Cliona*, Grant (Pls. XXV., XXIX.).

1826. *Cliona*, Grant, Edinburgh New Philosophical Journal, vol. i. p. 78.
1833. *Vioa*, Nardo, Isis, p. 523.
1866. *Hymeniacidon* (*pars*), Bowerbank, Mon. Brit. Spong., vol. ii. p. 212.

Suberitidæ of boring habit. Spicules tylostyli.

Our knowledge of the boring sponges and their classification is perhaps in a more unsatisfactory condition than our knowledge of any other group of like importance amongst the Monaxonida. In the first place it appears to us that far too much stress has been laid on the mere boring habit as a character of classificatory importance, and that it is a mistake to group together all the boring sponges as necessarily belonging to even the same subfamily, while it is quite unnecessary to erect a special group for their reception, like the "*Eccælonida*" of Mr. Carter.[1]

It appears, however, that nearly all the boring sponges as yet known belong to the *Clavulina*, but some belong to the family Suberitidæ, while others belong to the Spirastrellidæ. The name *Cliona* must be confined to the former group, *i.e.*, to the species with no microsclera. This is the only genus here dealt with, and so we shall not in this place discuss the matter further, merely stating that *Cliona* is a genus of Suberitidæ which has taken to boring habits.

Cliona dissimilis, Ridley and Dendy (Pl. XXV. figs. 5, 5*a*, 5*b*, 5*c*, 5*d*; Pl. XXIX. fig. 8).

1886. *Cliona dissimilis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 490.

Sponge (Pl. XXV. figs. 5, 5*a*) encrusting and boring into a Madreporarian Coral (*Turbinaria* sp.). The corallum of the *Turbinaria* forms a tabular lamella about 13 mm. thick, now broken into several large pieces. This is coated on both surfaces by a very thin

[1] *Journ. Roy. Micr. Soc.*, vol. ii. p. 496.

layer (ectosome) of the *Cliona*, and is also penetrated through and through by the sponge (choanosome). The tubular canals penetrating the Coral in every direction ramify and anastomose and appear on the surface at fairly regular intervals in the form of circular, vertical pits.[1] Each of these pits is closed at the top by a thick, cushion-like pad of sponge tissue. These cushions are merely portions of the general crust which the *Cliona* forms on the surface of the corallum, but whereas the crust is in most places only about 0·2 to 0·25 mm. thick, in the cushion-like areas it attains a thickness of about 0·4 mm. on the one side of the corallum, and 0·8 mm. on the other (*vide* annexed woodcut). On the one surface, again (Pl. XXV. fig. 5), the pits are very much more abundant than on the other (Pl. XXV. fig. 5*a*), and average about 2 mm. in diameter, while the distance between two adjacent pits is also about 2 mm. On this surface the cushions are also much thicker than on the other (*vide supra*), and they present no appearance of perforation to the naked eye, though there is commonly a slight depression in the centre (Pl. XXV. fig. 5*c*). On the opposite surface the pits are fewer and less regularly arranged, and the cushion-like pads of tissue have each a small, but distinct, oscular perforation through the centre (Pl. XXV. fig. 5*b*). *Colour* of the sponge in spirit light brown. *Oscula* minute (Pl. XXV. fig. 5*b*, *o* and woodcut Fig. 11, *o*), one in the centre of each cushion-like area on one surface only of the sponge. *Pores*, narrow, slit-like perforations, between vertical brushes of spicules, many in each cushion-like area on the opposite side of the sponge (woodcut, Fig. 11, *pa*).

Fig. 11.—*Cliona dissimilis*. Vertical section of a decalcified specimen; *o*,*o*, oscula; *pa*, pore-areas. *c*, ectosome; *ic*, inhalent canals; *ec*, exhalent canals. × 4.

Skeleton.—The ectosome contains numerous, closely packed, tylostylote spicules, many (? most) of which are arranged more or less vertically to the surface, beyond which their apices project for a short distance. In the cushion-like areas on both surfaces the spicules are especially abundant and more regularly placed than in other parts of the ectosome; around each osculum they form a slightly projecting fringe (*vide* woodcut, Fig. 11). The skeleton in the main body of the sponge, *i.e.*, in the canals in the corallum, is very loose and scanty, consisting only of a few scattered spicules.

Spicules.—Megasclera; of one form only, viz., rather slender tylostyli (Pl. XXIX. fig. 8), with very well marked heads; size about 0·32 by 0·0065 mm.

This is an extremely interesting and well characterised species; the most important points about it are (1) that it completely envelops as well as bores into the organism

[1] Originally the calicular cavities of the Coral, of which the sponge has taken advantage.

which it inhabits; (2) that the oscula are confined to one surface and the pores to the other, exactly as in so many other sponges which have a lamellar form.

The most closely allied species already known appears to be *Cliona warreni*, Carter,[1] but this is obviously distinct, as will be seen by comparison of the description (*loc. cit.*) with ours.

Locality.—Station 188, September 10, 1874; lat. 9° 59′ S., long. 139° 42′ E.; south of New Guinea; depth, 28 fathoms; bottom, green mud.

Family II. Spirastrellidæ, Ridley and Dendy.

1886. *Spirastrellidæ*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 490.

Microsclera present; typically forming a more or less continuous dermal crust.

Genus *Spirastrella*, Schmidt (Pls. XLI., XLV.).

1868. *Spirastrella*, Schmidt, Die Spongien d. Küste v. Algier., p. 17.

Sponge usually massive. Megasclera all monactinal, stylote or tylostylote. Microsclera spined spirulæ, occurring mainly as a dermal crust.

Schmidt founded the genus for his species *Spirastrella cunctatrix*, and gives only the following very brief generic diagnosis. "In der Rindenschicht eine eigenthümliche Art von strahligen Kieselkörperchen, deren Strahlen spiralig gestellt sind." A good many species have been discovered since and the Challenger adds three new ones.

Spirastrella decumbens, Ridley, var. (Pl. XLV. figs. 12–12*g*).

1884. *Spirastrella decumbens*, Ridley, Zool. Coll. H.M.S. "Alert," Brit. Mus., p. 470, pl. xliii. fig. *c*.

Represented in the collection by a single fine specimen, consisting of a number of stout, irregular, anastomosing trabeculæ, forming together a sessile, cavernous mass, 70 mm. long. by 44 mm. broad. The original type was encrusting and thin, and of small size, and must, therefore, be regarded as only a young specimen. There are also slight differences in the proportions of the spicules between our specimen and the type, the tylostyli (Pl. XLV. fig. 12) and spined spirulæ (Pl. XLV. figs. 12*a*–12*g*) being both of rather more robust growth in the Challenger specimen, the tylostyli measuring 0·4 by 0·015 mm., the spirulæ 0·028 by 0·007 mm. (exclusive of the spines); but there are no differences sufficient to justify us in separating the two specifically.

[1] *Ann. and Mag. Nat. Hist.*, ser. 5, vol. vii. p. 370.

Locality.—Station 208, January 17, 1875; lat. 11° 37′ N., long. 123° 31′ E.; Philippine Islands; depth, 18 fathoms; bottom, blue mud. One specimen.

Habitat.—Torres Strait (Ridley, "Alert"); Philippine Islands (Challenger).

Spirastrella massa, Ridley and Dendy (Pl. XLV. figs. 14–14*k*).

1886. *Spirastrella massa*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 490.

Sponge massive, represented in the collection by two large, squarish blocks, which have evidently been cut out of a very large specimen, or possibly from two. *Colour* in spirit pale, greyish-yellow. *Texture* fairly compact throughout, but rather spongy. *Surface* almost glabrous in appearance, but rather lumpy and uneven; very minutely hispid. *Dermal membrane* thin, transparent. *Oscula;* one or two scattered ones, of moderate size, have been observed, but it is very probable that many more were present in the entire specimen; possibly they were mainly localised in some portion of the sponge which has not been preserved. *Pores*, small round openings, thickly scattered in some parts, so as almost to reduce the dermal membrane to a network, very rare or almost undiscernible in other parts; diameter, taken from a part of the sponge where they were abundant, about 0·06 mm.

Skeleton.—Very diffuse and with no distinct spiculo-fibre; consisting of abundant, irregularly scattered stylote and subtylostylote spicules. Immediately beneath the surface these spicules are much more closely packed than elsewhere and are also, for the most part, horizontally disposed. They thus form a fairly thick cortical layer, not, however, very well defined from the deeper skeleton. At the surface itself are irregular tufts of stylote spicules whose apices project for a short distance beyond the dermal membrane.

Spicules.—(*a*) *Megasclera;* slightly curved, rather slender, smooth styli or subtylostyli (Pl. XLV. figs. 14, 14*a*, 14*b*); the heads, when present, are somewhat irregularly developed; apex not very constant in form, sometimes very sharply and gradually pointed, at others more blunt, sometimes slightly and irregularly jagged; size about 0·45 by 0·0065 mm.; in the surface brushes a trifle shorter. (*b*) *Microsclera;* small spined spirulæ (Pl. XLV. figs. 14*c*–14*k*), the largest of which are slender, have five or six bends, and measure about 0·044 mm. in length. These are, however, not nearly so numerous as the smaller ones, which often consist of only one short length with spined ends; about 0·0095 mm. long. As forms intermediate between the two described can be found, it seems probable that they are all merely different stages of the same spicule. These spicules are nowhere abundant except in the dermal membrane, where they are very plentiful.

Perhaps the two most remarkable characteristics of this species are its singularly

massive external form and the shape of the megasclera. *Spirastrella cunctatrix*, Schmidt,[1] approaches it in spiculation, but in that species both megasclera and microsclera are of decidedly more robust growth, and the megasclera are usually very distinctly tylostylote and quite straight, while the form of the spined spirulæ is also different. *Spirastrella massa* is also remarkable for the great irregularity in the shape of the megasclera; these are often very abnormal in appearance and may even (though rarely) become oxeote; this should perhaps be connected with the apparent interchangeability (in different species) of the stylote and oxeote spicules, and with the instability in the condition of the ends of the oxeote in *Latrunculia* (?) *acerata*, nobis.

Locality.—Station 162, April 2, 1874; lat. 39° 10′ 30″ S., long. 146° 37′ 0″ E.; Bass Strait; depth, 38 fathoms; bottom, sand and shells. Two large pieces.

Spirastrella solida, Ridley and Dendy (Pl. XLI. fig. 7; Pl. XLV. figs. 13–13*e*).

1886. *Spirastrella solida*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 491.

Sponge (Pl. XLI. fig. 7) erect, sessile, lobate or digitate; consisting of a broad base, containing a large amount of embedded foreign matter, from which arise broad, fleshy-looking lobes, the larger of which have each one osculum (? sometimes more) at the summit. Height of the largest specimen 88 mm.; breadth at base 54 mm. *Colour* in spirit light yellow. *Texture* very firm and hard throughout, excepting immediately around the larger canals, where there is a well defined zone of soft, gelatinous, transparent tissue enclosing and following the course of the canal. In the wider parts of the exhalent canals, near the summits of the lobes, the same kind of tissue forms well defined circular diaphragms, each with only a small aperture in the centre. *Surface* rather lumpy and uneven, almost glabrous in appearance yet harsh to the touch. *Dermal membrane* difficult to distinguish as such, being very heavily laden with the characteristic microsclera. *Oscula* few in number, but of fair size, occurring (? singly) at the tops of the lobes. *Pores* irregularly but very plentifully scattered over the general surface of the sponge; they are round openings about 0·044 mm. in diameter.

Skeleton.—Consisting throughout of an extraordinarily dense, but quite irregular reticulation of interlacing tylostylote spicules; no spiculo-fibre. At the surface are loose, radiating brushes of smaller, straight, tylostylote spicules, whose apices project for a short distance beyond the surface.

Spicules.—(*a*) *Megasclera;* (1) the main spicules, almost straight, fairly stout tylostyli (Pl. XLV. fig. 13), with well developed subglobular heads and rather blunt apices; size about 0·7 by 0·19 mm. (2) The spicules of the surface brushes; nearly or quite straight, slender tylostyli with well developed subglobular heads and sharply pointed

[1] Spongien d. Küste v. Algier., p. 17.

apices; size about 0·31 by 0·0094 mm. (*b*) *Microsclera;* (1) very minute, slender, spined spirulæ (Pl. XLV. figs. 13*a*–13*d*), with some three or four bends and warty rather than spiny; length about 0·0126 mm., diameter about 0·0025 mm. (2) There are also a few much longer and, relatively, much slenderer spined spirulæ; in these it is almost impossible to say how many bends there are, they are as a rule simply crooked and rather minutely spined; length about 0·056 mm. These latter are probably merely elongated forms of the smaller kind. The microsclera are, as usual, most abundant in the dermal membrane, where they form a solid crust penetrated by the pores, but they are also fairly plentifully scattered in the deeper tissues of the sponge.

The tendency to form lobes, shown in some degree by previously described species of the genus, is here carried to an unusual extent. The texture is unusually dense, forming perhaps the most characteristic feature of the species.

Locality.—Station 208, January 17, 1875; lat. 11° 37′ N., long. 123° 31′ E.; Philippine Islands; depth, 18 fathoms; bottom, blue mud. Two fine specimens, and a fragment, containing a very large amount of foreign matter, chiefly shells, which seems to belong to the same species.

Spirastrella papillosa, Ridley and Dendy (Pl. XLI. fig. 5; Pl. XLV. figs. 11–11*g*).

1886. *Spirastrella papillosa*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 491.

Sponge (Pl. XLI. fig. 5) massive, erect, sessile; shape conical, broad at the base and tapering gradually to an obtuse apex, where are situated several large oscula. Near the apex the surface is thrown into deep longitudinal wrinkles. The entire surface, except in the immediate neighbourhood of the oscula, is covered with numerous, closely placed papillæ of considerable size; these show a tendency towards arrangement in longitudinal series; towards the apex of the sponge they decrease in size. Height of specimen about 150 mm.; breadth at base 100 mm. *Colour* in spirit grey. *Texture* fairly firm, but rather spongy and, internally, cavernous. *Surface* uneven, as described above, with a minutely reticulate appearance, and harsh to the touch. The reticulate appearance is caused, or at any rate largely helped, by the arrangement of the microsclera, which are thickly scattered through the dermal membrane in such a manner as to leave small rounded patches, the meshes of the reticulation, almost or quite free from their presence. In these areas are situated the pores, and the corresponding arrangement of the underlying subdermal cavities also helps to give the reticulate appearance to the surface. *Dermal membrane* thin, transparent. *Oscula* large, six or seven in number, grouped at the summit of the sponge, each about 6 mm. in diameter, sometimes a little more. *Pores;* very numerous, rounded openings, thickly placed in the meshes of the

dermal reticulation, where they reduce the dermal membrane to a mere network; diameter about 0·05 mm.

Skeleton.—Very diffuse and with only very slightly developed spiculo-fibre; consisting of thickly but irregularly scattered tylostylote spicules, sometimes arranged in tracts; towards the surface the skeleton becomes much denser so as to form a kind of cortical layer. This is most strongly pronounced in the mammiform processes, where it consists of a very dense reticulation of interlacing spicules. The cortical layer is, however, much broken up by the large, irregularly shaped, subdermal cavities, and it is not very sharply marked off from the deeper skeleton. At the surface of the sponge are irregular brushes of smaller tylostylote spicules whose apices project for a short distance beyond the dermal membrane.

Spicules.—(*a*) *Megasclera;* (1) the main spicules; straight or slightly curved, gradually and sharply pointed, fairly stout tylostyli (Pl. XLV. fig. 11), with well developed, broadly oval heads; size about 0·5 by 0·0157 mm. (2) The spicules of the surface brushes; smaller, straight, slender tylostyli (Pl. XLV. figs. 11*a*, 11*b*), commonly with well developed, broadly oval heads and gradually and finely pointed apices; size about 0·3 by 0·008 mm. (*b*) *Microsclera;* stout spined spirulæ (Pl. XLV. figs. 11*c*–11*g*), consisting each of three or four bends and with abundant strong spines; size, exclusive of spines about 0·5 by 0·009 mm.; smaller ones of rather different appearance are also abundant, but they are probably only young forms of the larger. These spicules occur in very great numbers in the dermal membrane and for a short distance below it.

The peculiar warty appearance of the surface seems to be the most characteristic feature of this species, but, owing to information received from Dr. R. von Lendenfeld, we are doubtful whether this will turn out to be a constant character.

Locality.—Port Jackson; depth, 30 to 35 fathoms. One specimen.

Genus *Latrunculia*, Bocage (Pls. XXIX., XLIV., XLV.).

1870. *Latrunculia*, Bocage, Jorn. Acad. real. Sci. Lisboa, vol. ii. p. 161.
1875. *Sceptrella*, Schmidt (*pars*), Jahresb. Comm. wiss. Unters. deutsch. Meere, Jahrg. ii., iii. p. 119.

Sponge massive, sessile, usually corticate. Upper surface usually covered with mammiform projections. Megasclera smooth styli (? or oxea). Microsclera discastra, characteristic of the genus and typically forming a dense dermal crust.

The numerous small mammiform processes are very characteristic of this genus; some of these bear oscula while others are raised pore-areas; we cannot, however, say whether this arrangement obtains in all species.

Bocage (*loc. cit.*) gives no attempt at a generic diagnosis but plunges at once into the description of the type species, *Latrunculia cratera*. Previous to the appearance of our

Preliminary Report only three sponges had been described under the name *Latrunculia* viz.:—*Latrunculia cratera*, Bocage (*loc. cit. supra*); *Latrunculia corticata*, Carter[1] and *Latrunculia purpurea*, Carter.[2] Both of Mr. Carter's species have, however, oxeote in place of stylote megasclera; in this they agree with one of the Challenger species and all are thereby very sharply marked off from the original type and from three new species obtained by the Challenger; indeed it seems doubtful whether these forms with oxeote megasclera ought to be included in the same genus with the species that have stylote spicules; this question we must leave open for the present, but for the sake of convenience we shall consider those forms with oxeote spicules as doubtfully belonging to the genus *Latrunculia*.

Schmidt has described two sponges under the generic name *Sceptrella;* the first of these, viz., *Sceptrella regalis*,[3] is of rather doubtful systematic position, though almost certainly referable to the genus *Latrunculia*. *Sceptrella triloba*,[4] the second species, is undoubtedly a *Latrunculia* (*Latrunculia triloba*), as will readily be seen from Schmidt's brief description, which we quote in full:—"Bildet Krusten, am Rande mit röhrenförmigen Fortsätzen, welche theils eine wirkliche Osculum-Oeffnung haben, theils bloss durch microscopische Poren den Wasserabfluss gestatten. Die st.-sp. Nadeln in der Mitte etwas dicker. Zwischen diesen gröberen feinere. Die characterischen Schachfigurenförmigen Kieselkörper zeigen die grösste Verwandtschaft mit denen der Sceptr. regalis von Florida, ihre vier Wirtel bestehen aber nur aus drei Strahlen, welche sich ein- bis zweimal dichotomisch gabeln. Diese Körper bilden, indem ihre Axen senkrecht zur Oberfläche stehen, ein dichtes Pflaster."

Podospongia lovenii, Bocage,[5] seems to be nearly allied to the genus *Latrunculia*, but, without entering into the question of spiculation, the presence of a very distinct stalk is sufficient to separate it generically.

Latrunculia apicalis, Ridley and Dendy (Pl. XLIV. fig. 4; Pl. XLV. figs. 9–9*c*).

1886. *Latrunculia apicalis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 492.

Sponge (Pl. XLIV. fig. 4) massive, sessile, with broad base attached to foreign objects, and very strongly convex upper surface beset with more or less numerous small, mammiform processes. The largest specimen (the one from Kerguelen) measures 114 mm. in length by 75 mm. in breadth and 56 mm. in thickness in the middle, the base is oval and the upper surface very strongly convex and beset with an enormous number of small

[1] *Ann. and Mag. Nat. Hist.*, ser. 5, vol. iii. p. 298, pl. xxvii. figs. 3–4.
[2] *Op. cit.*, ser. 5, vol. vii. p. 380, pl. xviii. fig. 5.
[3] Spong. Atlant. Gebiet., p. 58, pl. v. fig. 24. The systematic position of this sponge is discussed in our Introduction.
[4] Jahresb. d. Comm. wiss. Unters. deutsch. Meere, Jahrg, ii., iii., p. 119, pl. i. figs. 17, 18.
[5] Jorn. Acad. real Sci. Lisboa, vol. ii. p. 159, pl. x. fig. 1.

mammiform processes; towards the summit of the sponge many of these processes are larger than elsewhere, measuring about 6 mm. in height; these are conical and have each a distinct oscular opening at the top. Much more abundant are the smaller processes, which occur abundantly all over the upper surface of the sponge, excepting where they are replaced by the larger ones; they are very short, cylindrical, and abruptly truncated at the top. The larger processes are undoubtedly cloacal tubes, and we were at first inclined to think that the small ones might be the same in a state of retraction, but we have now very strong evidence in favour of regarding them as raised pore-areas. Canals in the body of the sponge lead up to both kinds; the smaller ones, however, appear to the naked eye to be almost all closed at the top. This description also applies fairly to the two specimens from Station 320. The larger of the two is more globular and smaller than the Kerguelen sponge; the difference between the large and small papilliform processes is not so well marked; but the sponge is in poor condition for making out anatomical details; it is even impossible to decide whether there was one or more large oscula at the summit; that there was at least one is certain. The small processes are more conical in form, and, though plentiful, not nearly so abundant as in the Kerguelen sponge. *Colour* in spirit (of the specimens from Station 320) yellowish-grey. The specimen from Kerguelen is of a deep chocolate brown colour throughout; but as all the specimens in the bottle with it, and also the parchment label, were found to be stained of the same colour, we cannot be certain to which sponge the colour may be proper. *Texture* fairly compact, but spongy throughout, with tough, parchment-like dermal layer easily separable from the deeper tissues. In the Kerguelen specimen the cortex is a good deal thicker than in the specimens from Station 320, and may be described as tough and leathery. *Surface* smooth between the mammiform processes, but rather harsh to the touch. *Oscula* on the tops of mammiform processes. *Pores;* narrow perforations through the flat tops of the smaller mammiform projections, leading into large inhalent canals.

Skeleton.—There is a dermal crust composed of a single layer of the characteristic *Latrunculia* "chess-man" spicules (discastra), vertically placed and with outwardly directed, elongated apices. Below these the skeleton is very loose and irregular, composed of abundant smooth stylote spicules disposed without any definite order. Immediately below the surface these spicules tend to be vertically arranged, but this layer passes very soon into a much denser but utterly irregular reticulation, and below this again, forming the main mass of the skeleton, is a loose, irregular reticulation of the same spicules, often forming incipient fibres but with no distinguishable primary and secondary lines. The discastra also occur scattered promiscuously throughout the sponge. In the Kerguelen specimen the dermal layer of discastra is immediately backed up by a thick, dense layer of closely interwoven stylote spicules. It thus appears that there is great irregularity in the arrangement of the main skeleton.

Spicules.—(*a*) *Megasclera;* smooth, rather slender styli (Pl. XLV. fig. 9), hastately pointed and often slightly crooked; size about 0·6 by 0·014 mm.; often with slight irregular inflations on the shaft. In the Kerguelen specimen these spicules are a trifle shorter and stouter, and there occur also a very few, apparently abnormal, much larger forms. (*b*) *Microsclera;* discastra, the "chess-man" spicules, which in this species resemble in form miniature fir trees (Pl. XLV. figs. 9*a*, 9*b*, 9*c*); each spicule is composed of an expanded, spinose base, followed immediately by a rather irregular whorl of separate short spines; then comes a short, stout, smooth, cylindrical shaft which suddenly expands into a broad, flattened, circular whorl with denticulated margin; three of the indentations are so deep as to cut right down to the shaft, thereby dividing the circle into three distinct segments (Pl. XLV. fig. 9*b*). This is much the largest of the whorls, and is followed by three or four others gradually lessening in size till they end in a few small spines on the shaft. The shaft itself is produced into a long, smooth, terminal portion, gradually tapering to a fine point, and sometimes curved. Total length of spicule about 0·126 mm., of which the apical prolongation may form nearly half; diameter of largest whorl about 0·044 mm.

The most characteristic feature about this species, and that from which the specific name has been derived, is the apical prolongation of the discaster, by which it may at once be distinguished. The geographical distribution is very interesting; we have, during the course of our description, indicated various slight differences between the specimens from the two localities, but there is nothing to justify us in separating them specifically. Details regarding the minute anatomy will be found in the Introduction.

Localities.—Off Christmas Harbour, Kerguelen, January 29, 1874; depth, 70 fathoms. One specimen.

Station 320, February 14, 1876; lat. 37° 17′ S., long 53° 52′ W.; off the mouth of the Rio de la Plata; depth, 600 fathoms; bottom, green sand; bottom temperature, 37°·2. Two specimens.

Latrunculia brevis, Ridley and Dendy (Pl. XLIV. fig. 5; Pl. XLV. figs. 10, 10*a*).

1886. *Latrunculia brevis*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 492.

Sponge (Pl. XLIV. fig. 5) massive, sessile, usually attached by the base to some foreign object, and with more or less convex upper surface beset with numerous conical processes. The best specimen in the collection is attached by a narrow base to a fragment of *Sporadopora;* it is about 63 mm. in diameter, and the upper surface is rather flattened and thickly covered with the conical osculum-bearing processes, which are about 6 mm. in height. *Colour* in spirit yellowish-grey. *Texture* fairly compact

throughout, but soft and spongy, with easily separable, parchment-like cortex. *Surface* smooth between the conical processes, but rather harsh to the touch. *Oscula* on the tops of conical processes. *Pores* (probably as in *Latrunculia apicalis*).

Skeleton.—There is a dense dermal crust, composed as usual of a single layer of vertically placed discasters; and below this there is a loose, irregular reticulation of stylote spicules, in which one may distinguish poorly developed lines of fibre, some running towards the surface representing the primary skeleton lines.

Spicules.—(*a*) *Megasclera;* smooth styli (Pl. XLV. fig 10), straight or very slightly crooked, with evenly rounded bases and more or less hastately pointed apices, not very sharp; size about 0·6 by 0·126 mm. (*b*) *Microsclera*, discastra; for these we refer to Pl. XLV. fig. 10*a*, and also to the description of the corresponding spicules in *Latrunculia apicalis*, merely stating that they differ chiefly from the latter in having no apical prolongations; the upper whorls are approximated so as to form a thick brush at the top, the largest occupying the same position as in *Latrunculia apicalis;* length about 0·05 mm., diameter of largest whorl about 0·044 mm.

The form of the "chess-man" spicule is, as usual in the genus *Latrunculia*, the most characteristic feature of the species. (This remark would scarcely be applicable to *Latrunculia cratera*, Bocage,[1] should the very minute size of the megasclera, viz., 0·18 mm. long, as ascertained by calculation from the figure, which would at once distinguish it from all the Challenger species, be confirmed.)[2]

A slight variety, of which there is one specimen, from the same station as the types of the species, has the "chess-man" spicule a trifle (but very slightly) elongated and the whorls much further apart from one another as compared with the type; thereby making an approach to the Kerguelen species, *Latrunculia bocagei*, nobis.

It would be curious, if it should prove to be correct, that there should be only one form of mammiform processes in this species, that all should be conical and osculum-bearing, with no raised pore-areas. We are, however, strongly inclined to think, both from the analogy of other species and from the enormous number of the projections, which can scarcely all be cloacal tubes, that the raised pore-areas would be found to exist in more perfectly preserved specimens, although in the Challenger specimens they are indistinguishable from the osculum-bearing processes.

Locality.—Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; off the mouth of the Rio de la Plata; depth, 600 fathoms; bottom, green sand; bottom temperature, 37°·2. About ten specimens in poor condition, being a good deal crushed.

[1] Jorn. Acad. real Sci. Lisboa, vol. ii. p. 161, pl. xi. fig. 2.

[2] See, however, the remarks after the next species.

Latrunculia bocagei, Ridley and Dendy (Pl. XLIV. fig. 1; Pl. XLV. figs. 8, 8*a*).

1886. *Latrunculia Bocagei*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 492.

Sponge (Pl. XLIV. fig. 1) massive, sessile; the two specimens in the collection are both subglobular and have been attached to foreign objects by constricted bases. The strongly convex upper surface is covered with very numerous papilliform processes; a few of these, at the top of the sponge, are rather larger than the rest, in form conical, and each with a small oscular opening at the apex. The remainder are cylindrical rather than conical in form, narrow, somewhat elongated and abruptly truncated at the top, where no distinct opening can be seen; evidently they are raised pore-areas as in *Latrunculia apicalis*. There is a distinct, thick, leathery cortex, easily separable from the underlying tissues. The larger of the two specimens measures about 38 mm. in diameter. *Colour* in spirit very pale yellow. One specimen, which was found in the same bottle with the dark-coloured specimen of *Latrunculia apicalis*, is, like it, of a dark chocolate colour throughout; but since the other specimen, which was in another bottle, is of a very pale yellow colour, we must attribute the brown coloration of the former specimen to the action of some staining substance dissolved in the spirit and probably derived from some other sponge. *Texture* of the cortex tough and leathery, of the inner parts fairly compact, but rather soft and spongy. *Surface* fairly smooth between the numerous processes, but rather harsh to the touch and wrinkled in places, especially around the oscula. *Oscula* distributed singly on the tops of conical eminences. *Pores* (doubtless arranged as in *Latrunculia apicalis*, though this has not been absolutely proved).

Skeleton.—Arranged as usual in the genus, with an external layer of the discasters, and an internal, confused mass of smooth styli, with ill developed fibres, making up the main skeleton. In both specimens of this species, however, the layer of "chess-man" spicules is backed up by a thick cortical layer of densely interlacing stylote spicules, as in the Kerguelen specimen of *Latrunculia apicalis*, and not by a mere film of interlacing spicules as in *Latrunculia brevis*.

Spicules.—(*a*) *Megasclera;* smooth, slightly crooked, more or less hastately pointed styli (Pl. XLV. fig. 8), measuring about 0·6 by 0·018 mm. (*b*) *Microsclera;* discastra, differing somewhat in form from those of any other known species; each spicule (Pl. XLV. fig. 8*a*) has a slightly expanded base armed with two whorls of spines, then comes the smooth, stout shaft bearing three distinct, subequal whorls, well separated from one another, and ending in a crown-like tuft of spines which follows close upon the last whorl. Each of the three disc-like whorls is deeply notched along the rim, but the notches are not equal all the way round. Length of the spicule about 0·07 mm., diameter of whorls about 0·03 mm.

In this species, again, the form of the "chess-man" spicule is, as usual, the distinguishing feature. The figures will show that it is really distinct from the corresponding spicules in *Latrunculia apicalis* and *Latrunculia brevis*, although, as we have already had occasion to mention, there is a slight variety of the latter which seems to form a connecting link between the two; the spicule in *Latrunculia bocagei* is larger and narrower than in *Latrunculia brevis*, and the arrangement and relative sizes of the whorls different. *Latrunculia cratera*, Bocage, the original type of the genus, comes near to our species in this respect, but in that species the whorls are much more minutely and evenly dentate all the way round the rim, and the uppermost one is much smaller than the others. According to Bocage's figures, also, the stylote spicule in *Latrunculia cratera* is only 0·18 mm. long; but here we feel strongly inclined to think that there has been some error, for we have found that the constancy in size of the stylote spicule is a remarkable feature of the genus; and a preparation in the British Museum, identified by Schmidt with *Latrunculia bocagei*, while agreeing with the latter as regards the form of the "chess-man" spicule, has the stylus about 0·5 mm. long.

As regards external form it will be seen that *Latrunculia bocagei* is almost indistinguishable from the Kerguelen specimen of *Latrunculia apicalis*, and correspondingly different from *Latrunculia brevis;* but in this case we are not inclined to set much value on external form as a specific character, for we have already seen that the specimens of *Latrunculia apicalis* from Kerguelen and from Station 320 respectively, differ in external appearance; indeed, to judge from the Challenger series of specimens of the genus, it would seem that external appearance depends on the locality and that all the species from the same locality tend to have a similar external form.

Locality.—Kerguelen; depth, 10 to 70 fathoms. Two specimens.

Latrunculia (*?*) *acerata*, Ridley and Dendy (Pl. XXIX. figs. 3, 3*a*, 3*b*).

1886. *Latrunculia* (*?*) *acerata*, Ridley and Dendy, Ann. and Mag. Nat. Hist., ser. 5, vol. xviii. p. 492.

Sponge massive, amorphous, spreading. There is only one specimen in the collection, and that in a very bad state of preservation. It forms a flattened, shapeless mass about 50 mm. long by 38 mm. broad and 13 mm. thick. *Colour* in spirit dirty brown. *Texture* rather firm and compact. *Surface* very uneven, irregularly grooved; at present carrying a considerable amount of foreign matter. *Dermal membrane* distinct, strong, supported by very numerous spicules; in parts peeling off. *Oscula* (?). *Pores* scattered through the dermal membrane (a fragment of the dermal membrane, which was boiled in nitric acid for the sake of separating the spicules, appeared at the end of the process uninjured, and showed the pores very distinctly).

Skeleton.—(*a*) *Dermal;* varying much in its degree of development at different parts of the surface. Typically a more or less closely matted, irregular feltwork of slender strongylote spicules, much smaller than the spicules of the main skeleton. (*b*) *Main;* also varying much in its degree of compactness; a more or less definite reticulation of large spicules, with fibres three or four spicules broad, distinct in parts; sometimes primary fibres, running towards the surface, can be distinguished from the remainder.

Spicules.—(*a*) *Megasclera;* (1) long, smooth, more or less curved oxea (Pl. XXIX. fig. 3), very variable at the ends, sometimes gradually and sharply pointed, sometimes blunted at each end; ends often rather irregular; size about 0·9 by 0·025 mm., forming the main skeleton. (2) Smooth, rather slender, very slightly curved strongyla (Pl. XXIX. fig. 3*a*), rounded off at each end, measuring about 0·48 by 0·012 mm., occurring chiefly in the dermal skeleton. (*b*) *Microsclera;* very small, slender discastra (Pl. XXIX. fig. 3*b*) resembling the typical "chess-man" spicules of *Latrunculia*, but not nearly so well developed. Consisting each of a slender shaft, straight or slightly crooked, sometimes rather expanded at the base, not distinctly spined but (commonly at any rate) with a roughened appearance; bearing two saucer-like whorls, a smaller one close to the base and a larger one some distance above it. There are never any indications of more whorls. The smaller one is slightly concave upwards and the larger slightly concave downwards. The margin of each whorl is normally slightly notched all round. The slender shaft is produced for some distance beyond the upper whorl, but instead of tapering off to a point it ends abruptly and is often of the same thickness along its entire course. Length of spicule about 0·037 mm. Diameter of larger whorl about 0·0125 mm. These spicules are abundantly scattered through the dermal membrane and are also found occasionally in the subjacent parts.

It is extremely unfortunate that the single specimen of this very interesting and important species should be in such poor condition, and also that the locality should be uncertain. The label on the bottle bears the inscription "*No.* 135 ? *Date.* Oct. 1873. *Lat.* *Long.* *Depth,* 60 fm's."

The species is at once distinguished from any of the three preceding by its spiculation (oxea instead of styli), and by the absence of mammiform processes on the surface. Indeed, as we have already pointed out, it is very doubtful whether it even belongs to the same genus. It is distinguished from Mr. Carter's two species, *Latrunculia corticata*[1] and *Latrunculia purpurea*,[1] which also have oxeote megasclera, by the form of the discaster, which in our species approaches that of a typical *Latrunculia* much more nearly than in either of Mr. Carter's. This forms an argument for including all in the same genus, but it is a very slight one when compared with the arguments against this view. As, however, we have only a single specimen we leave it where it is for the present.

[1] *Loc. cit. supra.*

GEOGRAPHICAL AND BATHYMETRICAL DISTRIBUTION.

LIST OF LOCALITIES AT WHICH MONAXONID SPONGES WERE OBTAINED, WITH THE SPECIES OBTAINED AT EACH.

STATION 24. March 25, 1873; lat. 18° 38′ 30″ N., long. 65° 5′ 30″ W.; West Indies; depth, 390 fathoms; bottom, Pteropod ooze.

Desmacella annexa.

Bermuda, West Indies.

Tedania digitata, var. *bermudensis.*

STATION 49. May 20, 1873; lat. 43° 3′ 0″ N., long. 63° 39′ 0″ W.; south of Halifax, Nova Scotia; depth, 85 fathoms; bottom, gravel, stones; bottom temperature, 35°·0.

Artemisina suberitoides.
Polymastia robusta.
Tentorium semisuberites.
Stylocordyla stipitata.
Quasillina brevis.

STATION 50. May 21, 1873; lat. 42° 8′ 0″ N., long. 63° 39′ 0″ W.; south of Nova Scotia; depth, 1250 fathoms; bottom, blue mud; bottom temperature, 38°·0.

Tentorium semisuberites.

STATION 73. June 30, 1873; lat. 38° 30′ 0″ N., long. 31° 14′ 0″ W.; depth, 1000 fathoms; bottom, Pteropod ooze; bottom temperature, 39°·4.

Rhizochalina fistulosa (*?*).
Trichostemma sarsii.

STATION 75. July 2, 1873; lat. 38° 38′ 0″ N., long. 28° 28′ 30″ W.; off the Azores; depth, 450 fathoms; bottom, volcanic mud.

Reniera implexa.
Gellius angulatus.
Plocamia coriacea, var. *elegans.*
Suberites carnosus.
Suberites elongatus.
Polymastia agglutinans.

Cape Verde Islands.

Reniera tufa.
Hymeniacidon caruncula.
Axinella monticularis.
Axinella (?) lunæcharta.

Off Fernando Noronha.

Suberites carnosus.

Station 122c. September 10, 1873; lat. 9° 10′ 0″ S., long. 34° 49′ 0″ W.; east of Brazil; depth, 400 fathoms; bottom, red mud.

Phakellia ventilabrum, var. *connexiva.*

Station 125. September 12, 1873; lat. 10° 46′ 0″ S., long. 36° 2′ 0″ W.; between Pernambuco and Bahia; depth, 1200 fathoms; bottom, red mud.

Polymastia corticata.

Off Bahia.

Pachychalina fibrosa.
Rhizochalina putridosa (?).
? Oceanapia robusta.
Toxochalina robusta.
Esperella nuda.
Esperella fusca.
Desmacidon reptans.
Myxilla plumosa, var. *fusifera.*
Rhaphidophlus gracilis.
Plumohalichondria plumosa.
Axinella echidnæa.
Axinella reticulata.
Raspailia tenuis.
Thrinacophora funiformis.
Stylocordyla stipitata.

Off Tristan da Cunha.

Axinella erecta.

Off Nightingale Island, Tristan da Cunha.

Iophon pattersoni.
Axinella erecta.

Inaccessible Island, Tristan da Cunha.

Axinella erecta.
Axinella (?) paradoxa.
Tentorium semisuberites.

Station 135. October 15, 1873; lat. 37° 1′ 50″ S.; long. 12° 19′ 10″ W.; Tristan da Cunha; depth, 360 fathoms; bottom, volcanic sand.

? Rhizochalina singaporensis.
? Gelliodes licheniformis.
? Agelas mauritianus.
? Latrunculia (?) acerata.

Simon's Bay, Cape of Good Hope.

Esperella simonis.
Desmacidon conulosa.
Desmacidon (Homœodictya) grandis.
Rhaphidophlus lobatus, var. *horrida.*
Raspailia flagelliformis.
Dendropsis bidentifera.
Proteleia sollasi.

STATION 142. December 18, 1873; lat. 35° 4′ 0″ S., long. 18° 37′ 0″ E.; south of the Cape of Good Hope; depth, 150 fathoms; bottom, green sand; bottom temperature, 47°·0.

Petrosia similis.
Gellius glacialis.
Vomerula esperioides.
Desmacidon (?) ramosa.
Iophon chelifer.
Myxilla digitata.
Raspailia (?) rigida.

Off Marion Island.

Halichondria sp. (*b*).
Gellius carduus.
Gellius flagellifer.
Desmacidon (?) ramosa.
Iophon abnormalis.
Amphilectus pilosus.
Myxilla mariana.
Axinella mariana.
Suberites caminatus.

Off Prince Edward Island.

Gellius carduus.

STATION 145. December 27, 1873; lat. 46° 43′ 0″ S., long. 38° 4′ 30″ E.; off Prince Edward Island; depth, 140 fathoms; bottom, volcanic sand.

Gellius glacialis, var. *nivea.*
Stylocordyla stipitata, var. *globosa.*

STATION 145A. December 27, 1873; lat. 46° 41′ 0″ S., long. 38° 10′ 0″ E.; off Prince Edward Island; depth, 310 fathoms; bottom, volcanic sand.

Esperiopsis symmetrica.
Iophon chelifer.
Iophon laminalis.
Phakellia papyracea.
Axinella erecta.

STATION 147. December 30, 1873; lat. 46° 16′ 0″ S., long. 48° 27′ 0″ E.; between Prince Edward Island and Crozet Islands; depth, 1600 fathoms; bottom, Diatom ooze; bottom temperature, 34°·2.

Esperella mammiformis.
Esperiopsis profunda.
Cladorhiza tridentata.
Meliiderma stipitata.
Axinella erecta.
Stylocordyla stipitata.

Station 148. January 3, 1874; lat. 46° 47′ 0″ S., long. 51° 37′ 0″ E.; Possession Island; depth, 210 fathoms; bottom, hard ground, gravel, shells.

Phakellia papyracea.
Suberites mollis.

Station 148A. January 3, 1874; lat. 46° 53′ 0″ S., long. 51° 52′ 0″ E.; south of Crozet Islands; depth, 240 to 550 fathoms; bottom, hard ground, gravel, shells.

Gellius carduus.
Iophon chelifer.
Myxilla nobilis.
Axinella erecta.

Kerguelen.

Halichondria panicea.
Petrosia hispida.
Pachychalina (?) pedunculata.
Desmacidon (Homœodictya) kerguelenensis.
Amphilectus apollinis.
Amphilectus pilosus.
Axinella balfourensis.
Suberites antarcticus.
Stylocordyla stipitata, var. *globosa.*
Latrunculia apicalis.
Latrunculia bocagei.

Station 150. February 2, 1874; lat. 52° 4′ 0″ S., long. 71° 22′ 0″ E.; west of Heard Island, Southern Ocean; depth, 150 fathoms; bottom, coarse gravel; bottom temperature, 35°·2.

Petrosia similis.
Myxilla fusca.
Suberites microstomus.

Station 157. March 3, 1874; lat. 53° 55′ 0″ S., long. 108° 35′ 0″ E.; Southern Ocean, south-west of Australia; depth, 1950 fathoms; bottom, Diatom ooze; bottom temperature, 32°·1.

Cladorhiza moruliformis.

Off the south-east coast of Australia.

Suberites durissimus.

Station 162. April 2, 1874; lat. 39° 10′ 30″ S., long. 146° 37′ 0″ E.; Bass Strait; depth, 38 fathoms; bottom, sand and shells.

Pachychalina elongata.
Pachychalina (?) punctata.
Chalina pergamentacea.
Chalina sp. (*b*).
Siphonochalina annulata.
Rhizochalina putridosa.
Tedania commixta.
Esperella arenicola.

STATION 162—*continued.*

Esperella sp.
Clathria elegantula.
Plumohalichondria mammillata.
Echinoclathria favus.
Echinoclathria carteri.
Echinoclathria glabra.
Spirastrella massa.

STATION 163A. April 4, 1874; lat. 36° 59′ 0″ S., long. 150° 20′ 0″ E.; south-east of Australia; depth, 150 fathoms; bottom, green mud.

Desmacidon fruticosa, var.
Iophon cylindricus.
Iophon (?) omnivorus.
Clathria inanchorata.
Echinoclathria carteri.

Off Port Jackson, Australia.

Pachychalina lobata.
Siphonochalina intermedia.
Rhizochalina putridosa.
Gelliodes poculum.
Tedania digitata.
Tedania digitata, var. *fibrosa.*
Esperella murrayi.
Esperella porosa.
Esperiopsis cylindrica.
Amphilectus ceratosus.
Clathria lendenfeldi.
Echinoclathria carteri.
Phakellia flabellata.
Axinella arborescens.
Suberites carnosus.
Suberites perfectus.
Spirastrella papillosa.

STATION 163D. June 12, 1874; lat. 33° 57′ 30″ S., long. 151° 39′ 15″ E.; depth, 120 fathoms; bottom, green sand.

Pachychalina megalorrhaphis.
Tedania massa (?).

STATION 170. July 14, 1874; lat. 29° 55′ 0″ S., long. 178° 14′ 0″ W.; off Kermadec Islands; depth, 520 fathoms; bottom, volcanic mud; bottom temperature, 43°·0.

Myxilla frondosa.

STATION 174. August 3, 1874; lat. 19° 6′ 0″ S., long. 178° 14′ 20″ E.; Kandavu, Fiji Islands; depth, 140 fathoms; bottom, coral mud.

Chondrocladia clavata.

Api, New Hebrides.

Halichondria solida, var. *rugosa.*
Rhizochalina pedunculata.

STATION 184. August 29, 1874; lat. 12° 8′ 0″ S., long. 145° 10′ 0″ E.; south-east of Cape York; depth, 1400 fathoms; bottom, Globigerina ooze; bottom temperature, 36°·0.

Trichostemma sarsii.

Torres Strait.

Chalina sp. (*a*). | *Esperella gelatinosa.*
Gelliodes fibulata. | *Clathria decumbens.*
Acanthella pulcherrima.

STATION 186. September 8, 1874; lat. 10° 30′ 0″ S., long. 142° 18′ 0″ E.; off Cape York, Torres Strait; depth, 8 fathoms; bottom, coral mud.

Chalina palmata. | *Clathria aculeata.*
Acanthella (*?*) *stipitata*, var.

STATION 188. September 10, 1874; lat. 9° 59′ 0″ S., long. 139° 42′ 0″ E.; west of Torres Strait; depth, 28 fathoms; bottom, green mud.

Rhizochalina fistulosa (*?*). | *Clathria frondifera.*
Sideroderma navicelligerum. | *Cliona dissimilis.*

STATION 190. September 12, 1874; lat. 8° 56′ 0″ S., long. 136° 5′ 0″ E.; south-west of New Guinea; depth, 49 fathoms; bottom, green mud.

Echinodictyum rugosum.

STATION 192. September 26, 1874; lat. 5° 49′ 15″ S., long. 132° 14′ 15″ E.; off Little Ki Island, south of New Guinea; depth, 140 fathoms; bottom, blue mud.

Esperiopsis pulchella. | *Myxilla paucispinata.*

Amboina.

Halichondria pelliculata.

STATION 196. October 13, 1874; lat. 0° 48′ 30″ S., long. 126° 58′ 30″ E.; east of Celebes Island; depth, 825 fathoms; bottom, hard ground; bottom temperature, 36°·9.

Esperiopsis challengeri.

STATION 203. October 31, 1874; lat. 11° 6′ 0″ N., long. 123° 9′ 0″ E.; Philippine Islands; depth, 20 fathoms; bottom, mud.

Halichondria sp. (*c*).

STATION 207. January 16, 1875; lat. 12° 21′ 0″ N., long. 122° 15′ 0″ E.; Philippine Islands; depth, 700 fathoms; bottom, blue mud; bottom temperature, 51°·6.

Suberites ramulosus.

STATION 208. January 17, 1875; lat. 11° 37′ 0″ N., long. 123° 31′ 0″ E.; Philippine Islands; depth, 18 fathoms; bottom, blue mud.

Petrosia variabilis.	*Gellius varius.*
Petrosia similis, var. *compacta.*	*Esperella parishii.*
Petrosia truncata.	*Rhaphidophlus filifer.*
Pachychalina fragilis.	*Hymeniacidon (?) subacerata.*
Pachychalina melior.	*Thrinacophora cervicornis.*
Pachychalina fibrosa, var.	*Spirastrella decumbens.*
Chalina rectangularis.	*Spirastrella solida.*

STATION 209. January 22, 1875; lat. 10° 14′ 0″ N., long. 123° 54′ 0″ E.: Philippine Islands; depth, 95 fathoms: bottom, blue mud; bottom temperature, 71°·0.

Reniera cinerea.	*Suberites ramulosus*, var. *cylindrifera.*

STATION 214. February 10, 1875; lat. 4° 33′ 0″ N., long. 127° 6′ 0″ E.; east of Meangis Island, south of Philippine Islands; depth, 500 fathoms: bottom, blue mud; bottom temperature, 41°·8.

Esperiopsis challengeri, var. *meangensis.*

STATION 216A. February 16, 1875; lat. 2° 56′ 0″ N., long. 134° 11′ 0″ E.; north of New Guinea; depth, 2000 fathoms; bottom, Globigerina ooze; bottom temperature, 35°·4.

Chondrocladia crinita.

Japan.

Halichondria panicea.	*Myxilla rosacea*, var. *japonica.*

STATION 241. June 23, 1875: lat. 35° 41′ 0″ N., long. 157° 42′ 0″ E.; North Pacific Ocean; depth, 2300 fathoms: bottom, red clay; bottom temperature, 35°·1.

Axinella profunda.

STATION 246. July 2, 1875; lat. 36° 10′ 0″ N., long. 178° 0′ 0″ E.: North Pacific Ocean: depth, 2050 fathoms; bottom, Globigerina ooze; bottom temperature, 35°·1.

Suberites senilis.

STATION 248. July 5, 1875: lat. 37° 41′ 0″ N., long. 177° 4′ 0″ W.: North Pacific Ocean; depth, 2900 fathoms; bottom, red clay; bottom temperature, 35°·1.

Chondrocladia concrescens (?).

Honolulu.

Esperiopsis anomala.

Station 264. August 23, 1875; lat. 14° 19′ 0″ N., long. 152° 37′ 0″ W.; North Pacific Ocean; depth, 3000 fathoms; bottom, red clay; bottom temperature, 35°·2.

Cladorhiza longipinna.

Station 274. September 11, 1875; lat. 7° 25′ 0″ S., long. 152° 15′ 0″ W.; Mid Pacific Ocean; depth, 2750 fathoms; bottom, Radiolarian ooze; bottom temperature, 35°·1.

Cladorhiza abyssicola, var. *rectangularis.*

Tahiti.

Halichondria solida. | *Acarnus ternatus.*

Echinodictyum asperum.

Station 281. October 6, 1875; lat. 22° 21′ 0″ S., long. 150° 17′ 0″ W.; South Pacific Ocean; depth, 2385 fathoms; bottom, red clay; bottom temperature, 34°·9.

Esperella biserialis. | *Cladorhiza similis.*

Cladorhiza abyssicola, var. *linearis.* | *Axinella profunda.*

Station 291. October 27, 1875; lat. 39° 13′ 0″ S., long. 118° 49′ 0″ W.; South Pacific Ocean; depth, 2250 fathoms; bottom, red clay; bottom temperature, 34°·6.

Esperella biserialis. | *Axoniderma mirabile.*

Station 299. December 14, 1875; lat. 33° 31′ 0″ S., long. 74° 43′ 0″ W.; west of Valparaiso; depth, 2160 fathoms; bottom, blue mud; bottom temperature, 35°·2.

Tedania actiniiformis. | *Trichostemma irregularis.*

Station 306A. January 2, 1876; lat. 48° 27′ 0″ S., long. 74° 30′ 0″ W.; off the south-west coast of Patagonia; depth, 345 fathoms; bottom, blue mud; bottom temperature, 46°·0.

Myxilla cribrigera.

Station 307. January 4, 1876; lat. 49° 24′ 30″ S., long. 74° 23′ 30″ W.; off the south-west coast of Patagonia; depth, 140 fathoms; bottom, blue mud.

Reniera subglobosa. | *Myxilla nobilis*, var. *bacillifera.*

STATION 308. January 5, 1876; lat. 50° 8′ 30″ S., long. 74° 41′ 0″ W.; off the west coast of Patagonia; depth, 175 fathoms; bottom, blue mud.

Tedania tenuicapitata.
Trachytedania patagonica.
Iophon pattersoni.

STATION 311. January 11, 1876; lat. 52° 45′ 30″ S., long. 73° 46′ 0″ W.; off the south-west coast of Patagonia; depth, 245 fathoms; bottom, blue mud; bottom temperature, 46°·0.

Gellius carduus, var. *magellanica.*
Tedania tenuicapitata.
Iophon pattersoni.
Myxilla nobilis, var. *patagonica.*

Off the south-west coast of Patagonia.

Halichondria caduca.
Reniera aquæductus, var. *infundibularis.*
Tedania tenuicapitata.
Tedania infundibuliformis.
Trachytedania patagonica.
Myxilla mollis.
Myxilla mariana, var. *massa.*
Hymeniacidon (?) hyalina.
Suberites spiralis.

STATION 313. January 20, 1876; lat. 52° 20′ 0″ S., long. 67° 39′ 0″ W.; east of the Strait of Magellan; depth, 55 fathoms; bottom, sand; bottom temperature, 47°·8.

Tedania massa.
Esperella magellanica.
Esperiopsis edwardii, var. *americana.*
Hymeniacidon sp.
Axinella fibrosa.

STATION 314. January 21, 1876; lat. 51° 35′ 0″ S., long. 65° 39′ 0″ W.; between the Strait of Magellan and the Falkland Islands; depth, 70 fathoms; bottom, sand; bottom temperature, 46°·0.

Petrosia similis, var. *massa.*
Tedania tenuicapitata.

STATION 317. February 8, 1876; lat. 48° 37′ 0″ S., long. 55° 17′ 0″ W.; north-east of the Falkland Islands; depth, 1035 fathoms; bottom, hard ground (gravel); bottom temperature, 35°·7.

Phakellia ventilabrum, var. *connexiva.*

Station 320. February 14, 1876; lat. 37° 17′ 0″ S., long. 53° 52′ 0″ W.; off the mouth of the Rio de la Plata; depth, 600 fathoms; bottom, green sand; bottom temperature, 37°·2.

Halichondria latrunculioides.
Halichondria sp. (*a*).
Gellius lævis.
Gellius calyx.
Gellius flabelliformis.
Gellius sp.
Tedania massa.
Vomerula esperioides.
Esperella lapidiformis.
Phelloderma radiatum.
Amphilectus annectens.
Myxilla spongiosa.
Myxilla hastata.
Myxilla compressa.
Myxilla nobilis.
Ciocalypta hyaloderma.
Ciocalypta amorphosa.
Axinella (*?*) *tubulosa.*
Suberites caminatus, var.
Suberites axiatus.
Latrunculia apicalis.
Latrunculia brevis.

Station 332. March 10, 1876; lat. 37° 29′ 0″ S., long. 27° 31′ 0″ W.; South Atlantic; depth, 2200 fathoms; bottom, Globigerina ooze; bottom temperature, 34°·0.

Cladorhiza inversa.

Table of Species obtained by the Challenger, showing their Geographical and Bathymetrical Range.[1]

	North Atlantic (Stations 1.–110, and 348–354).	South Atlantic (Stations 111–143, and 317–347).	Southern Ocean (Stations 144–160).	Indo-Australian (Stations 161–165, and 181–220).	North Pacific (Stations 221–270).	South Pacific (Stations 165–180), and 271–303).	Patagonian (Stations 304–316).	0–50 Fathoms.	50–200 Fathoms.	200–1000 Fathoms.	1000–3000 Fathoms.
Halichondria panicea,			×		×			×	×		
,, *caduca*,							×				
,, *solida*, n. sp.,						×		30–70			
,, ,, var. *rugosa*, nov.,						×			×		
,, *pelliculata*, n. sp.,				×					×		
,, *latrunculioides*, n. sp.,		×								×	
,, sp. (*a*),		×								×	
,, sp. (*b*),			×						×		
,, (?) sp. (*c*),				×				×			
Petrosia similis, n. sp.,		×	×						×		
,, ,, var. *massa*, nov.,							×		×		
,, ,, var. *compacta*, nov.,				×				×			
,, *truncata*, n. sp.,				×				×			
,, *variabilis*, var.,				×				×			
,, *hispida*, n. sp.,			×					×			
Reniera cinerea,				×					×		
,, *implexa*, var.,	×									×	
,, *aquæductus*, var. *infundibularis*, nov.,							×		×		
,, *subglobosa*, n. sp.,							×		×		
,, *tufa*, n. sp.,	×								×		
Pachychalina fragilis, n. sp.,				×				×			
,, *melior*, n. sp.,				×				×			
,, *fibrosa*, n. sp.,		?		×				×			
,, *lobata*,				×				×			
,, *megalorrhaphis*, n. sp.,				×					×		
,, *elongata*, n. sp.,				×				×			
,, (?) *punctata*, n. sp.,				×				×			
,, (?) *pedunculata*, n. sp.,			×					10–100			
Chalina palmata,				×				×			
,, *pergamentacea*,				×				×			
,, *rectangularis*, n. sp.,				×				×			
,, sp. (*a*),				×				×			
,, sp. (*b*),				×				×			

[1] This table comprises information derived from the Challenger material only; for fuller information as to the distribution of previously known forms the reader is referred to the Description of Genera and Species.

TABLE OF GEOGRAPHICAL AND BATHYMETRICAL RANGE—*continued.*

	North Atlantic (Stations 1.–110, and 348–354).	South Atlantic (Stations 111–143, and 317–347).	Southern Ocean (Stations 144–160).	Indo-Australian (Stations 161–165, and 181–220).	North Pacific (Stations 221–270).	South Pacific (Stations 165–180, and 271–303).	Patagonian (Stations 304–316).	0–50 Fathoms.	50–200 Fathoms.	200–1000 Fathoms.	1000–3000 Fathoms.
Siphonochalina intermedia, n. sp.,				×				×			
,, *annulata*, n. sp.,				×				×			
Rhizochalina fistulosa (?)	×			×				×		×	
,, *putridosa*,		?		×				×			
,, *singaporensis*,		?							?		
,, *pedunculata*, n. sp.,						×			×		
Oceanapia robusta,		?						?			
Gellius varius,				×				×			
,, *carduus*, n. sp.,			×						×	×	
,, ,, var. *magellanica*, nov.,							×			×	
,, *lævis*, n. sp.,		×								×	
,, *glacialis*, n. sp.,		×							×		
,, ,, var. *nivea*, nov.,			×						×		
,, *flagellifer*, n. sp.,			×						×		
,, *calyx*, n. sp.,		×								×	
,, *angulatus*,	×									×	
,, *flabelliformis*, n. sp.,		×								×	
,, sp.,		×								×	
Gelliodes fibulata,				×				×			
,, *licheniformis*,									?		
,, *poculum*, n. sp.,				×				×			
Toxochalina robusta,		×						×			
Tedania digitata,				×				×			
,, ,, var. *fibrosa*, nov.,				×				×			
,, ,, var. *bermudensis*, nov.,	×										
,, *tenuicapitata*,							×		×	×	
,, *commixta*, n. sp.,				×				×			
,, *massa*, n. sp.,		×		?			×		×	×	
,, *infundibuliformis*, n. sp.,							×				
,, *actiniiformis*, n. sp.,						×					×
Trachytedania patagonica, n. sp.,							×		×		
Desmacella annexa,	×									×	
Vomerula esperioides, n. sp.,		×							×	×	
Esperella mammiformis, n. sp.,			×								×
,, *lapidiformis*, n. sp.,		×								×	

TABLE OF GEOGRAPHICAL AND BATHYMETRICAL RANGE—*continued.*

	North Atlantic (Stations 1–110, and 348–354).	South Atlantic (Stations 111–143, and 317–347).	Southern Ocean (Stations 144–160).	Indo-Australian (Stations 161–165, and 181–220).	North Pacific (Stations 221–270).	South Pacific (Stations 165–180, and 271–303).	Patagonian (Stations 304–316).	0–50 Fathoms.	50–200 Fathoms.	200–1000 Fathoms.	1000–3000 Fathoms.
Esperella parishii,				×				×			
,, *gelatinosa*,				×				×			
,, *magellanica*,							×		×		
,, *murrayi*, n. sp.,				×				×			
,, *porosa*, n. sp.,				×				×			
,, *nuda*, n. sp.,		×						×			
,, *fusca*, n. sp.,		×						×			
,, *arenicola*, n. sp.,				×				×			
,, *simonis*, n. sp.,		×						×			
,, *biserialis*, n. sp.,						×					×
,, sp.,				×				×			
Esperiopsis symmetrica, n. sp.,			×							×	
,, *edwardii*, var. *americana*, nov.,							×		×		
,, *cylindrica*, n. sp.,				×				×			
,, *challengeri*, n. sp.,				×						×	
,, ,, var. *meangensis*, nov.,				×						×	
,, *profunda*, n. sp.,			×								×
,, *anomala*, n. sp.,					×			×			
,, *pulchella*, n. sp.,				×					×		
Cladorhiza abyssicola, var. *rectangularis*, nov.,						×					×
,, ,, var. *linearis*, nov.,						×					×
,, *moruliformis*, n. sp.,			×								×
,, *longipinna*, n. sp.,					×						×
,, *similis*, n. sp.,						×					×
,, *inversa*, n. sp.,		×									×
,, (?) *tridentata*, n. sp.,			×								×
Axoniderma mirabile, n. gen. et sp.,						×					×
Chondrocladia concrescens (?),					×						×
,, *clavata*, n. sp.,						×			×		
,, *crinita*, n. sp.,				×							×
Meliiderma stipitata, n. gen. et sp.,						×					×
Desmacidon fruticosa, var.,				×					×		
,, *reptans*, n. sp.,		×						×			
,, *conulosa*, n. sp.,		×						×			
(?) *ramosa*, n. sp.,		×	×						×		

TABLE OF GEOGRAPHICAL AND BATHYMETRICAL RANGE—*continued.*

	North Atlantic (Stations 1–110, and 348–354).	South Atlantic (Stations 111–143, and 317–347).	Southern Ocean (Stations 144–160).	Indo-Australian (Stations 161–165, and 181–220).	North Pacific (Stations 221–270).	South Pacific (Stations 161–180, and 271–303).	Patagonian (Stations 304–316).	0–50 Fathoms.	50–200 Fathoms.	200–1000 Fathoms.	1000–3000 Fathoms.
Desmacidon (*Homœodictya*) *kerguelenensis*, n. sp.,			×					×			
,, ,, *grandis*, n. sp.,		×						×			
Artemisina suberitoides,	×								×		
Phelloderma radiatum, n. gen. et sp.,		×								×	
Sideroderma navicelligerum, n. gen. et sp.,				×				×			
Iophon pattersoni,		×					×		×		
,, *chelifer*, n. sp.,		×	×						×	×	
,, *cylindricus*, n. sp.,				×					×		
,, *laminalis*, n. sp.,			×							×	
,, *abnormalis*, n. sp.,			×						×		
,, (?) *omnivorus*, n. sp.,				×					×		
Amphilectus apollinis, n. sp.,			×					20–60			
,, *ceratosus*, n. sp.,				×				×			
,, *pilosus*, n. sp.,			×						×		
,, *annectens*, n. sp.,		×								×	
Myxilla rosacea, var. *japonica*, nov.,					×			×			
,, *digitata*, n. sp.,			×						×		
,, *paucispinata*, n. sp.,				×					×		
,, *mollis*, n. sp.,							×				
,, *spongiosa*, n. sp.,		×								×	
,, *hastata*, n. sp.,		×								×	
,, *cribrigera*, n. sp.,							×			×	
,, *fusca*, n. sp.,			×						×		
,, *mariana*, n. sp.,			×						×		
,, ,, var. *massa*, nov.,							×				
,, *compressa*, n. sp.,		×								×	
,, *nobilis*, n. sp.,		×	×							×	
,, ,, var. *patagonica*, nov.,							×			×	
,, ,, var. *bacillifera*, nov.,							×		×		
,, *frondosa*, n. sp.,						×				×	
,, *plumosa*, var. *fusifera*, nov.,		×						×			
Clathria aculeata,				×				×			
,, *decumbens*,				×				×			
,, *lendenfeldi*, n. sp.,				×				?			
,, *frondifera*,				×				×			

TABLE OF GEOGRAPHICAL AND BATHYMETRICAL RANGE—*continued.*

	North Atlantic (Stations 1.–110, and 348–354).	South Atlantic (Stations 111–143, and 317–347).	Southern Ocean (Stations 144–160).	Indo-Australian (Stations 161–165, and 181–220).	North Pacific (Stations 221–270).	South Pacific (Stations 165–180, and 271–303).	Patagonian (Stations 304–316).	0–50 Fathoms.	50–200 Fathoms.	200–1000 Fathoms.	1000–3000 Fathoms.
Clathria elegantula, n. sp.,				×				×			
,, *inanchorata*, n. sp.,				×					×		
Rhaphidophlus gracilis,		×						×			
,, *filifer*, n. sp.,				×				×			
,, *lobatus*, var. *horrida*, nov.,		×						×			
Plumohalichondria mammillata,				×				×			
Plocamia coriacea, var. *elegans*, nov.,	×									×	
Acarnus ternatus,						×		×			
Echinoclathria favus,				×				×			
,, *carteri*, n. sp.,				×				×	×		
,, *glabra*, n. sp.,				×				×			
Agelas mauritianus,		!							?		
Echinodictyum rugosum, n. sp.,				×				×			
,, *asperum*, n. sp.,						×		×			
Hymeniacidon caruncula,	×							×			
,, sp.,							×		×		
,, (?) *hyalina*, n. sp.,							×				
,, (?) *subacerata*, n. sp.,				×				×			
Phakellia ventilabrum, var. *connexiva*, nov.,		×								×	×
,, *flabellata*, n. sp.,				×				×			
,, *papyracea*, n. sp.,			×							×	
Ciocalypta hyalodcrma, n. sp.,		×								×	
,, *amorphosa*, n. sp.,		×								×	
Acanthella pulcherrima, n. sp.,				×				×			
,, (?) *stipitata*, var.,				×				×			
Axinella arborescens, n. sp.,				×				×			
,, *balfourensis*, n. sp.,			×					20–	60		
,, *mariana*, n. sp.,			×						×		
,, *profunda*, n. sp.,					×	×					×
,, *erecta*,		×	×						×	×	×
,, *echidnœa*, var.,		×						×			
,, *fibrosa*, n. sp.,							×		×		
,, *reticulata*, n. sp.,		×						×			
,, *monticularis*, n. sp.,	×							×			
,, (?) *lunœcharta*, n. sp.,	×							×			

TABLE OF GEOGRAPHICAL AND BATHYMETRICAL RANGE—*continued.*

	North Atlantic (Stations 1–110, and 348–354).	South Atlantic (Stations 111–143, and 317–347).	Southern Ocean (Stations 144–160).	Indo-Australian (Stations 161–165, and 181–220).	North Pacific (Stations 221–270).	South Pacific (Stations 165–180, and 271–303).	Patagonian (Stations 304–316).	0–50 Fathoms.	50–200 Fathoms.	200–1000 Fathoms.	1000–3000 Fathoms.
Axinella (?) *tubulosa*, n. sp.,		×								×	
,, (?) *paradoxa*, n. sp.,		×							×		
Raspailia tenuis, n. sp.,		×						×			
,, *flagelliformis*, n. sp.,		×						×			
,, (?) *rigida*, n. sp.,		×							×		
Dendropsis bidentifera, n. gen. et sp.,		×						×			
Thrinacophora cervicornis, n. gen. et sp.,				×				×			
,, *funiformis*, n. sp.,		×						×			
Suberites carnosus,	×	×		×				×		×	
,, *caminatus*, n. sp.,			×						×		
,, *microstomus*, n. sp.,			×						×		
,, *perfectus*, n. sp.,				×				×			
,, *antarcticus*,			×						×		
,, *axiatus*, n. sp.,		×								×	
,, *durissimus*, n. sp.,				×							
,, *mollis*, n. sp.,			×							×	
,, *elongatus*, n. sp.,	×									×	
,, *spiralis*, n. sp.,							×				
,, *ramulosus*, n. sp.,				×						×	
,, ,, var. *cylindrifera*, nov.,				×					×		
,, *senilis*, n. sp.,					×						×
Polymastia robusta,	×								×		
,, *corticata*, n.		×									×
,, *agglutinans*, n. sp.,	×									×	
Proteleia sollasi, n. gen. et sp.,		×						×			
Trichostemma sarsii, n. sp.,	×			×						×	×
,, *irregulare*, n. sp.,						×					×
Tentorium semisuberites,	×	×							×		×
Stylocordyla stipitata,	×	×	×					×	×		×
,, ,, var. *globosa*, nov.,			×					10–100			
Quasillina brevis,	×								×		
Cliona dissimilis, n. sp.,				×				×			
Spirastrella decumbens, var.,				×				×			
,, *massa*, n. sp.,				×				×			
,, *solida*, n. sp.,				×				×			

TABLE OF GEOGRAPHICAL AND BATHYMETRICAL RANGE—*continued.*

	North Atlantic (Stations 1–110, and 348–354).	South Atlantic (Stations 111–142, and 317–347).	Southern Ocean (Stations 144–160).	Indo-Australian (Stations 161–165, and 181–220).	North Pacific (Stations 221–270).	South Pacific (Stations 166–180, and 271–303).	Patagonian (Stations 304–316).	0–50 Fathoms.	50–200 Fathoms.	200–1000 Fathoms.	1000–3000 Fathoms.
Spirastrella papillosa, n. sp.,				×				×			
Latrunculia apicalis, n. sp.,		×	×						×	×	
„ *brevis*, n. sp.,		×								×	
„ *bocagei*, n. sp.,			×					10–70			
„ (?) *acerata*, n. sp.,		?							?		

DISCUSSION OF THE GEOGRAPHICAL DISTRIBUTION.

In glancing over the list of localities at which Monaxonid sponges were obtained, one can scarcely fail to be struck with their small number as compared with the total number of dredgings made by the Challenger. Out of a total of 277 distinct stations we find only 50 represented in the collection, supplemented by 20 "localities" to which no station number is attached.

This is a very remarkable circumstance; it is probably to be accounted for partly by the fact already pointed out in our Introduction (p. v), viz., that the Monaxonida are, as a rule, very insignificant and uninteresting in external appearance, and hence extremely likely to be overlooked amongst the rubbish in sorting out the contents of the trawls and dredges, unless a specialist be on the spot to look out for them, and also partly by the fact that the sponges in question are usually very soft and fragile, and hence peculiarly liable to destruction by the rough treatment to which they are necessarily exposed in trawling, and, more especially, dredging operations.

These explanations are, however, hardly sufficient to account entirely for the absence of Monaxonida from the great majority of localities examined by the Challenger, and we are forced to conclude that the Monaxonida are not, on the whole, a predominant group in deep water, although, as we shall subsequently show, individual genera range down to very great depths, and are occasionally, but very rarely, found in great abundance in deep water (*e.g.*, Station 320). Thus, as the Challenger confined its operations mainly to deep water, we have an explanation of the facts before us; an explanation precisely similar in kind, though not so far reaching in degree, as that arrived at by Poléjaeff in the analogous case of the Keratosa.

Conversely, we find that in those cases where explorations were made by the Challenger in shallow or comparatively shallow water, rich harvests of Monaxonid

sponges were commonly obtained. We shall, however, return to the question of bathymetrical distribution later on, and refer to it in this place only in explanation of a very striking fact which meets us at the outset.

Comparatively little is as yet known of the geographical distribution of sponges at large, and still less, of course, of the distribution of the Monaxonida.

Vosmaer,[1] it is true, has dealt with the subject in some detail, and constructed tables both of geographical and bathymetrical range, but his results are far from being satisfactory. His list shows that sponges are most abundant in the Mediterranean and Atlantic Oceans, but, as he himself points out, this is only because the Mediterranean and Atlantic have been more or less thoroughly explored—witness Schmidt's works on the Atlantic, Adriatic and Algerian sponges, and Carter's researches on the Atlantic sponges obtained by the "Porcupine,"—while the sponge fauna of other seas and oceans is or has hitherto been almost entirely unknown. Hence it follows that the results of the Challenger Expedition taken alone are likely to give more trustworthy information on this head than those of all previous workers, simply because the observations were extended more impartially over an enormous area.

Vosmaer, then, makes six geographical areas, which, he tells us, are "vollkommen künstlich;" viz., Mediterranean, Atlantic Ocean, Pacific Ocean, Indian Ocean, Arctic Ocean, and Antarctic Ocean. Such an arrangement may be very suitable for general purposes, but is obviously inapplicable to the present case, as will be seen by a glance at the chart which illustrates our remarks on this head. The areas which we distinguish (*vide* Chart) are necessarily made to suit our own requirements. This is unfortunate, as it makes comparison a somewhat more difficult matter, but it cannot be avoided.

One or two peculiarities strike us in examining Vosmaer's table. Leaving out of account the Spongillids, with which we are not concerned in this place, we find here set forth the geographical distribution of 74 genera, or so-called genera, of Monaxonid sponges. Of these, two, viz., *Amphilectus* and *Clathria*, are stated to be cosmopolitan. The first, inasmuch as it is, as is stated[2] by Vosmaer himself, "nur ein vorläufiges Aushilfe-Genus, wo alle diejenigen Desmacidinen untergebracht sind, von welchen keine besondere Merkmale bekannt sind, wodurch sie zu einer anderen Gattung kommen sollten," might naturally be expected to be more or less cosmopolitan, while we are inclined altogether to deny the cosmopolitan character of the second (*Clathria*), at any rate until more evidence is forthcoming. It is not a little surprising to find that, according to Vosmaer, Monaxonid sponges[3] have been hitherto altogether unknown from the Antarctic Ocean, and that only nine genera are recorded from the Indian Ocean. Of course, in the present state of our knowledge, the only definite conclusion to be drawn from this is that

[1] Bronn's Klass. u. Ordnung. d. Thierrichs, Porifera, p. 447.

[2] Bronn's Klass. u. Ordnung. d. Thierreichs, Porifera, p. 353.

[3] Perhaps we ought to except the genera *Amphilectus* and *Clathria*, though the Antarctic Ocean is about the last place in which we should expect to find the latter.

these two areas have been less explored than elsewhere, and are especially deserving of attention at the hands of collectors, but Dr. Vosmaer must surely have overlooked Mr. Carter's *Suberites antarcticus* (*cf.* p. 201). Unfortunately the Challenger adds no information concerning the Indian Ocean, and this little known field will probably yield a rich harvest to whoever has the good luck to thoroughly investigate it.[1]

If we arrange our own seven geographical areas according to the number of species[2] obtained in each, we arrive at the following result:—Indo-Australian (74 species), South Atlantic (52 species), Southern Ocean (36 species), Patagonian (21 species), North Atlantic (19 species), South Pacific (16 species), North Pacific (7 species).[3]

Thus of the seven areas the Indo-Australian has proved to be the most prolific and the North Pacific the least so, and with this we must correlate the fact that the waters in the former area are, compared to those of the North Pacific, very shallow.

Of individual stations, however, Station 320 (off the mouth of the Rio de la Plata, 600 fathoms) has yielded by far the richest harvest. No less than 22 species were obtained here, presumably at a single haul of the trawl. These species were all of them new to science and most of them (*e.g.*, *Halichondria latrunculioides*, *Gellius calyx*, *Gellius flabelliformis*, *Tedania massa*, *Esperella lapidiformis*, *Phelloderma radiatum*, *Ciocalypta hyaloderma*, *Latrunculia apicalis* and *Latrunculia brevis*) of great and exceptional interest. This locality, indeed, seems to be a great focus of Monaxonid sponge life, where the conditions must be exceedingly favourable, and where not only is the diversity of species very great, but the individual species attain a high degree of development and a luxuriant growth, some of them (*e.g.*, *Tedania massa*) reaching huge proportions, and being represented in the collection by considerable numbers of specimens.

Simon's Bay, Cape of Good Hope, also proved to be of exceptional interest for the remarkable new species obtained there, for two of which we have been obliged to establish new genera (*Dendropsis* and *Proteleia*), and the seas in the neighbourhood of Port Jackson also yielded a very rich harvest, including, amongst a total of 17 species, such remarkable forms as *Siphonochalina intermedia*, *Esperella murrayi*, *Phakellia flabellata*, *Spirastrella papillosa*, and others. In these two cases, however, we do not know how much time and trouble was spent upon the collection of the material, so that it is hardly fair to compare them with individual stations where (presumably) only a single haul was taken.

Very interesting and novel results were also obtained at stations in the Pacific, Atlantic, and Southern Oceans where the depth exceeded 1000 fathoms, but in these cases the number of species obtained at each locality was always very small, the greatest

[1] *Cf.*, however, the Report on the Zoological Collections of H.M.S "Alert," Brit. Mus., 1884; and also Mr. Carter's papers on Sponges from the Gulf of Manaar, *Ann. and Mag. Nat. Hist.*, ser. 5, vol. vi. p. 35 and ser. 5, vol. vii. p. 361.

[2] For the sake of simplicity we here include varieties as distinct species.

[3] For the localities included by us in each area, *vide* Chart and Table of Geographical and Bathymetrical Range.

being 6 (Station 147, 1600 fathoms); but this question will be more fully dealt with in discussing the bathymetrical distribution.

The geographical range of individual species[1] appears, with few exceptions, to be somewhat restricted. As exceptions we may mention *Halichondria panicea*, *Reniera cinerea*, *Chalina pergamentacea*, *Tedania digitata*, *Iophon pattersoni*, *Axinella profunda*, *Suberites carnosus*, *Tentorium semisuberites* and *Latrunculia apicalis*. Five of these (Nos. 1, 2, 4, 5, 7) are very generalised types, with few definite specific characters to go by, and might consequently be expected to have a very wide range. One, *Axinella profunda*, comes from very deep water (2300 and 2385 fathoms) at widely remote localities in the North and South Pacific respectively (*cf.* p. 181), but apparently under exactly similar conditions in the two cases; while the distribution of the remaining three is very hard to understand. The genera and families, on the other hand, have mostly a very wide range, although some appear to be characteristic of special localities and to be comparatively rare elsewhere. Thus the Chalininæ and Ectyoninæ are highly characteristic of the Indo-Australian area, and the Tedaniinæ more or less so of the Patagonian area.

DISCUSSION OF THE BATHYMETRICAL DISTRIBUTION.

We have already had occasion to point out that the Monaxonida are not a predominant group in very deep water. If we analyse our table of bathymetrical distribution as we did that of geographical distribution we shall find this conclusion fully confirmed, especially if we bear in mind the large proportion of Challenger dredgings which were taken in deep water as compared with those taken in shallow water. Our four bathymetrical areas may then be arranged as follows, according to the number of species[2] obtained in each:—0–50 fathoms (85 species); 50–200 fathoms (55 species); 200–1000 fathoms (46 species); 1000–3000 fathoms (24 species). Here then we have the very definite result that the number of species varies in inverse proportion to the depth, or in other words that the number of species gradually diminishes as we go downwards.

According to Vosmaer[3] (and we have no reason to doubt the correctness of his statement) the greatest depth at which a Monaxonid sponge has hitherto been obtained is 860 fathoms (recorded for *Cladorhiza*). This depth is now extended to 3000 fathoms (for *Cladorhiza longipinna*, nobis) by the results of the Challenger investigations, which

[1] For details as to the geographical distribution of individual species the reader is referred to the Table and to the Description of Genera and Species.

[2] For the purpose of simplifying the discussion, varieties are here again treated as distinct species; which these are will be seen by reference to the Table of Geographical and Bathymetrical Range.

[3] Bronn's Klass. u. Ordnung. d. Thierreichs, Porifera, p. 455.

have brought to light no less than 24 species of Monaxonid sponges (belonging to 14 genera) which live below the thousand fathom line, amongst which 13 live at depths of 2000 fathoms or more, as will be seen from the following list :—

LIST OF SPECIES WHICH LIVE BELOW THE 1000 FATHOM LINE.

	Species.	Depth in fathoms.
1.	*Tedania actiniiformis*,	2160
2.	*Esperella mammiformis*,	1600
3.	„ *biserialis*,	2250 and 2385
4.	*Esperiopsis profunda*,	1600
5.	*Cladorhiza abyssicola*, var. *rectangularis*,	2750
6.	„ „ var. *linearis*,	2385
7.	„ *moruliformis*,	1950
8.	„ *longipinna*,	3000
9.	„ *similis*,	2385
10.	„ *inversa*,	2200
11.	„ (?) *tridentata*,	1600
12.	*Axoniderma mirabile*,	2250
13.	*Chondrocladia concrescens*,	2900
14.	„ *crinita*,	2000
15.	*Meliiderma stipitatum*,	1600
16.	*Phakellia ventilabrum*, var. *connexiva*,	1035
17.	*Axinella profunda*,	2300 and 2385
18.	„ *erecta*,	1600
19.	*Suberites senilis*,	2050
20.	*Polymastia corticata*,	1200
21.	*Trichostemma sarsii*,	1000 and 1400
22.	„ *irregulare*,	2160
23.	*Tentorium semisuberites*,	1250
24.	*Stylocordyla stipitata*,	1600

Of the 14 genera thus represented, 9 (*Cladorhiza*, *Axoniderma*, *Chondrocladia*, *Meliiderma*, *Phakellia*, *Polymastia*, *Trichostemma*, *Tentorium* and *Stylocordyla*) must be regarded as characteristically belonging to the deep-sea fauna, being rarely or never met with in shallow water, while the remaining five are on the contrary typically more or less shallow-water forms, and are rarely met with at very great depths.

The scarcity of Monaxonid sponges at very great depths is fully compensated for by the unusual interest attaching to the few species which do occur. In examining the twenty-

four species just enumerated, and comparing them with their shallow-water allies, we cannot fail to be struck with one very remarkable fact, and this is that while the shallow water species are characteristically more or less amorphous in external form, or, at the most, simply digitate or ramose, those from below the thousand fathom line have, almost without exception, beautifully symmetrical and definite shapes. This interesting circumstance is probably to be accounted for by the fact that the deep-sea forms are exposed to precisely similar external conditions for very long periods of time, and variations in any one particular direction (which prove to be advantageous to the species under its particular external conditions) have time to develop into fixed and definite characters; while in the shallow-water forms the ever changing external conditions necessitate corresponding changes in the sponge, and no external forms can become fixed and permanent, excepting such as, from their very general and unpronounced character, are suited to the ever varying conditions under which they are placed.

We have already had occasion to show, in discussing the value of external form as a guide to classification, that it is of all characters perhaps the most variable and, consequently, the least trustworthy. The particular external form which a deep-sea sponge assumes may not infrequently be explained by reference to the conditions under which it lives, and in this fact lies strong confirmation of the views to which we have just given expression.

Thus in *Tedania actiniiformis*, a sponge whose shallow-water congeners are characteristically shapeless, the peculiar external appearance (Pl. XI. fig. 2), and chiefly the arrangement of the pores and oscula, are explained by the fact that the sponge lives on a bottom of mud in which it is nearly buried.

Many of the most remarkable external forms which we know are due to the necessity of obtaining some means of support to prevent the sponge from sinking bodily into the soft mud or ooze which is so prevalent at great depths. Thus we can easily account for the "Crinorhiza" forms already discussed,[1] and for the analogous "Trichostemma" forms.[2] Nor need we be surprised that species of distinct (though allied) genera (*e.g.*, *Cladorhiza*, *Axoniderma*, and *Chondrocladia*), all living under precisely similar conditions, arrive at a precisely similar solution of this difficult problem of support, viz., the "*Crinorhiza*" form.

Other perfectly definite and characteristic external forms found in deep-sea sponges are, however, as yet unaccounted for. Amongst these we may mention those of *Stylocordyla* and *Tentorium;* but by far the most extraordinary and beautiful is that exhibited by *Esperiopsis challengeri* (Pl. XVIII.) which has been fully described elsewhere,[3] and which comes from a depth of 825 fathoms (hence it is not included in the foregoing list, which contains only species from a depth of over 1000 fathoms, though of course a deep-sea form).

[1] *Vide* p. 87. [2] *Vide* p. 216 *et seq.* [3] *Vide* p. 80.

We may briefly sum up our conclusions with regard to the geographical and bathymetrical distribution as follows:—

1. The Monaxonida as a group are cosmopolitan.
2. They are most abundant in the Indo-Australian area.
3. Individual species have not usually a very wide range, and rarely or never except in the case of generalised types, or where the conditions of life are very similar, as in the case of *Axinella profunda*.
4. They are most abundant in shallow water and gradually decrease in numbers as we go downwards. The limit of depth, so far as we at present know, is 3000 fathoms.
5. The shallow-water species are characteristically without any definite, symmetrical external form; but in the abyssal species a perfectly definite and usually symmetrical external form is almost invariably present.

APPENDIX.

SYNONYMY OF THE SPICULAR TERMINOLOGY.

The synonymy here given does not pretend to be complete. It is intended for the use of those who are already acquainted with the principal terms used by other authors. For further synonyms of continental authors *vide* Vosmaer's article on the Porifera (p. 151) in Bronn's Klassen und Ordnungen des Thierreichs.

The symbol = must here be interpreted in a wide sense. The terms used by us include but are not necessarily co-extensive with those of other authors given.

1. *Megasclera* = skeleton spicules (*auctorum*).
   - *Oxea* = acerates (Bowerbank); ac.^{2}, ac. ac. (Vosmaer).
   - *Tornota* = hastately pointed acerates.
   - *Strongyla* = cylindricals (Bowerbank, &c.); tr.^{2} (Vosmaer).
   - *Tylota* = biclavated cylindricals (Bowerbank); bicapitate cylindricals; tibiellæ (Carter); tr^{02} (Vosmaer).
   - *Styli* = acuates (Bowerbank); tr. ac. (Vosmaer).
   - *Tylostyli* = spinulates (Bowerbank); tr^{0}ac (Vosmaer).
   - *Subtylostyli* = subspinulates (*auctorum*).
   - *Cladostrongyla* = (new type).
   - *Cladotylota* = spinulo-recurvo-quaternates (? &c.) (Bowerbank).
2. *Microsclera* = flesh spicules (*auctorum*).
   - *Rhaphides* = trichites (*auctorum*).
   - *Trichodragmata* = trichite sheaves, or bundles (*auctorum*).
   - *Toxa* = tricurvates (*auctorum*); tricurvato-acerates (Bowerbank); ⋀ (Vosmaer).
   - *Toxodragmata* = tricurvate sheaves.
   - *Sigmata* = bihamates (Bowerbank); ∾ (Vosmaer).
   - *Sigmadragmata* = bihamate sheaves.
   - *Diancistra* = trenchant bihamates (Bowerbank); ⋚ (Vosmaer).
   - *Chelæ* = anchorates (Bowerbank).
   - *Isochelæ* = equianchorates (Bowerbank); anc^2 (Vosmaer); rut.^{2} (Vosmaer).
   - *Anisochelæ* = inequianchorates (Bowerbank); anc. anc. (Vosmaer); rut. rut. (Vosmaer).
   - *Bipocilli* = bipocillate bihamates (Bowerbank); grotesque spicules (Carter).
   - *Spirulæ* = multiangulated cylindricals, spinulo-multiangulated cylindricals, elongo-attenuato-stellates (Bowerbank); spini-spirulæ (Carter).
   - *Discastra* = sceptrellæ (Carter).
   - *Amphiastra* = birotulates (Bowerbank); amphidisks (*auctorum*).

INDEX.

Note.—The numbers of the pages on which the species, &c., are most fully dealt with are printed in darker type.

	Plate	Page
abnormalis (Iophon), .	xvii.	**122**, 243, 254
abyssicola (Cladorhiza),	...	86, 88, 90, 91, 248, 253, 261
abyssicola (Cladorhiza), var. corticocancellata, . . .	...	91, 98
abyssicola (Cladorhiza), var. linearis, . .	xx., xxi.	**90**, 248, 253, 261
abyssicola (Cladorhiza), var. rectangularis, .	xx.	86, **88**, 253, 261
Acanthella, . . .	xxxii.	xxii, xxiii, lix, **176**, 188, 246, 255
Acanthospongia, . .	...	viii
Acarnus, ...	...	xvii, lix, lx, 148, **159**, 248, 255
accrata (Latrunculia?) .	xxix.	231, **239**, 242, 257
Acervochalina, . .	...	26
Acervochalinida, .	...	ix
Actinia, ...	...	50
actiniiformis (Tedania),	xi., xxix.	xli, 50, **55**, 248, 252, 261, 262
aculeata (Clathria), .	...	**147**, 246, 254
acuta (Acanthella), .	...	176, 177
adriatica (Euspongia officinalis, var.), .	...	lii
ægagropila (Esperia), .	...	lii
aërophoba (Dendrilla),	...	xxiv
affinis (Microciona), .	...	110
Agelas, ...	xxix.	lix, **163**, 242, 255
agglutinans (Polymastia), . . .	xli., xlii.	xxviii, lxi, **212**, 241, 256
Alcyoncellidæ, . .	...	viii
Alcyoncellum, . .	...	liv
Alcyonium, . . .	...	33, 34
Alebion, ...	...	**116**, 117
Algæ (parasitic, &c.), .	...	3, 67, 72
ambigua (Cribrochalina),	...	172
ambigua (Reniera), .	...	51
ambigua (Tedania), .	...	51
americana (Esperiopsis edwardii, var.), .	xix.	**78**, 249, 253
Amorphina, . . .	...	1, 2, 167
amorphosa (Ciocalypta),	xl.	173, **175**, 250, 255
amphactis (Crinorhiza),	...	88
Amphilectus, . . .	xix., xxv., xlvii.	xviii, lix, 65, 78, 85, **123**, 149, 243, 244, 245, 250, 254, 258
Amphipoda (infesting sponge), . . .	...	124
Ancorinidæ, . .	...	viii, ix
angulata (Halichondria),	...	44
angulatus (Desmacodes),	...	44
angulatus (Gellius), .	...	38, **44**, 46, 241, 252
annectens (Amphilectus),	xix.	**127**, 250, 254
annexa (Desmacella), .	...	**59**, 241, 252
annexa (Desmacella vagabunda, var.), .	...	59
annexa (Desmacodes vagabundus, var.), .	...	59
annulata (Siphonochalina), . . .	vii.	30, **31**, 244, 252
anomala (Esperiopsis),	...	**84**, 248, 253
antarcticus (Suberites),	xlv.	**201**, 203, 244, 256, 259
Aphrocallistidæ, . .	...	viii
Aphrocerasidæ, . .	...	viii
apicalis (Latrunculia),	xliv., xlv., li.	xxxii, xxxviii, xxxix, xliii, xliv, xlv, xlvi, xlvii, xlviii, 7, **234**, 237, 238, 239, 244, 250, 257, 259, 260
Aplysinida, . .	...	ix
apollinis (Amphilectus),	xix.	**124**, 244, 254
appendiculatum (Histoderma), . . .	...	115
aquæductus (Reniera),	i., ii.	**16**, 249, 251
arborescens (Axinella),	xxxv.	**178**, 245, 255
arciger (Suberites), .	...	125
arcoferus (Gellius), .	...	38, 46
arenicola (Esperella), .	xv., xvi.	lxi, 65, **72**, 244, 253
Arenospongia, . .	...	viii

	Plate	Page
armigera (Cladochalina),	...	27
Artemisina,	...	lix, **112**, 124, 125, 241, 254
Askonematidæ,	...	viii
asperum (Echinodictyum),	XXXII.	**165**, 248, 255
Asychis,	...	37
Aulena,	...	xxiv
Auletta,	...	187
aulopora (Schmidtia),	...	10, 13
Aulospongus,	...	156
australiensis (Raspailia),	...	190
axiatus (Suberites).	XLV.	xxvi, 201, **203**, 250, 256
Axidæ,	...	viii
Axinella,	XXV., XXXIII., XXXIV., XXXV., XXXVI., XXXVII., XXXVIII., XL., XLIX.	xxii, xxiii, xxx, xxxiv, xliv, xlv, xlvi, lv, lix, lxii, 170, 173, **178**, 242, 243, 244, 245, 247, 248, 249, 250, 255, 256, 260, 261, 263
Axinellida,	...	ix
Axinellidæ,	...	xxv, xxvi, xlii, liv, lv, lix, lx, lxii, lxiii, lxvii, **166**, 207
Axoniderma,	XX., XXI.	xxi, xxvii, xxviii, liii, lix, 87, 88, 93, **96**, 102, 248, 253, 261, 262
Axos,	...	47
bacillifera (Myxilla nobilis, var.),	XXVII.	**142**, 248, 254
balfourensis (Axinella),	XXXIII.	**179**, 244, 255
bermudensis (Tedania digitata, var.),	...	**51**, 241, 252
Bibulida,	...	ix
bidentifera (Dendropsis),	XXXVIII., XL., XLVI.	xvii, **192**, 243, 256
Biemna,	...	32, 36
bihamigera (Myxilla (Microciona)),	...	139
biserialis (Esperella),	XIV., XV.	l, li, 62, **75**, 90, 248, 253, 261
bocagei (Latrunculia),	XLIV., XLV.	237, **238**, 244, 257
borassus (Esperia),	...	78
boreale (Hyalonema),	...	223
borealis (Stylocordyla),	...	223
bowerbanki (Phakellia),	...	xlvi
Brachiopod shell (encrusted by sponge),	...	198
brevis (Euplectella),	...	226
brevis (Latrunculia),	XLIV., XLV.	**236**, 238, 239, 250, 257, 259
brevis (Polymastia),	...	226
brevis (Quasillina),	...	225, **226**, 241, 256
Bubaris,	...	182
bullata (Tuba),	...	49
bursa (Weberella = Polymastia),	...	xlvi, xlvii
Bursalina,	...	**225**, 226, 227
Cacospongia,	...	xxxiii
caduca (Halichondria),	II.	**3**, 249, 251
Calcarea,	...	vi, vii, viii, x, 88
Calcispongia,	...	xi
Calcispongiæ,	..	vi, ix
caliciformis (Spongia),	...	172
calva (Ciocalypta),	...	173
calyx (Gellius),	VIII., XIII.	38, **43**, 46, 250, 252, 259
caminatus (Suberites),	XLI., XLV.	xxx, xliii, xlv, **198**, 200, 243, 250, 256
cancellatum (Echinodictyum),	...	165
carduus (Gellius),	VIII., XIII.	38, **39**, 40, 41, 243, 244, 249, 252
carduus (Spongia),	....	177
Carnosa,	...	vi, ix
carnosa (Halichondria),	...	197
carnosa (Hymeniacidon),	...	197
carnosa (Microciona),	...	145
carnosus (Suberites),	...	**197**, 241, 242, 245, 256, 260
Carteriadæ,	...	viii
carteri (Echinoclathria),	XXIX., XXXI.,	160, 161, **162**, 245, 255
caruncula (Amorphina),	...	167
caruncula (Hymeniacidon),	XXXIII.	xlv, 166, **167**, 242, 255
caruncula (Reniera),	...	167
Casuladæ,	...	viii
caulifera (Pachychalina),	...	25
Cavochalinida,	...	ix
Ceraospongiæ,	...	vi, ix, lxi
Ceratelladæ,	...	vii
Ceratina,	...	vi, ix, x
Ceratosa,	...	xi
ceratosus (Amphilectus),	XIX., XXV., XLVII.	**125**, 245, 254
cervicornis (Thrinacophora),	XXXVI., XL.	193, **194**, 247, 256
Chalina,	V., XLVI.	vii, xxv, lviii, lxiii, 15, **25**, 108, 109, 244, 246, 247, 251, 260
Chalineæ,	...	ix, 18
Chalinida,	...	ix
Chalinidæ,	...	vii, viii
Chalinina,	...	18
Chalininæ,	...	liv, lv, lvi, lviii, lx, lxi, lxiii, lxvii, **18**, 49, 260
Chalinopsidinæ,	...	ix
Chalinopsis,	...	163
Chalinula,	...	lii, 26

	Plate	Page
hallengeri (Amphilectus),	...	80
challengeri (Esperiopsis),	XVIII., XIX.	xxii, xxiii, xli, xliii, xlv, xlviii, **80**, 246, 247, 253, 262
chelifer (Iophon),	XVI., XVII.	xxi, xxviii, **119**, 243, 244, 254
Chondrilladæ,	...	viii
Chondrocladia,	XX., XXI.	xix, xxvii, xlix, l, liii, lix, 86, 88, 94, 97, **99**, 102, 245, 247, 253, 261, 262
Chondrosiosa,	...	xi
Choristida,	...	xi
cinerea (Halichondria),	...	15
cinerea (Isodictya),	...	15
cinerea (Reniera),	...	**15**, 247, 251, 260
cinerea (Spongia),	...	15
Ciocalypta,	XXXIII., XL.	xlii, liv, lix, **173**, 250, 255, 259
Cladochalina,	...	22, 26
Cladorhiza,	XX., XXI., XLIX.	xx, xxi, xxvii, xxxiv, xlix, liii, lix, 62, 76, 78, **86**, 97, 98, 99, 102, 243, 244, 248, 250, 253, 260, 261, 262
clathrata (Raspailia),	...	190
clathrata (Tenacia),	...	147
Clathria,	XXVIII., XXIX., XLVII.	xxv, lv, lix, 9, 125, 129, 145, **146**, 153, 154, 155, 160, 178, 245, 246, 254, 255, 258
clavata (Chondrocladia),	XX., XXI.,	**100**, 245, 253
Clavulina,	...	x, xxv, xxxiv, xxxvi, xlii, xliii, xlv, xlvi, xlvii, xlix, lv, lvi, lix, lx, lxi, lxii, lxvii, lxviii, **196**
Cliona,	XXV., XXIX.	xlii, lix, **227**, 246, 256
Clioniadæ,	...	vii, viii, x, lxviii
colonensis (Forcepia),	...	xviii
commixta (Tedania),	XXIII.	lxi, **52**, 244, 252
compacta (Petrosia similis, var.),	II., III.	**12**, 247, 251
compacta (Reniera),	...	17
compressa (Clathria),	...	147
compressa (Desmacidon),	...	106, 108
compressa (Myxilla),	XXVII.	xl, 129, **139**, 250, 254
concrescens (Chondrocladia),	XX., XXI.	xix, **99**, 247, 253, 261
concrescens (Cladorhiza),	...	**99**
connexiva (Phakellia ventilabrum, var.),	XXXV., XLIX.	xxx, xl, xli, xlv, xlvi, xlviii, **170**, 242, 249, 255, 261
conulosa (Desmacidon),	XXIII., XXIV.	**106**, 109, 112, 243, 253
Coralliospongia,	...	viii
coralloides (Clathria),	...	147
Corbitellidæ,	...	viii
coriacea (Isodictya),	...	158
coriacea (Plocamia),	...	158, 241, 255
coriacea (Plocamia, var. elegans),	XXIX., XXXI.	**158**
coriacea (Siphonochalina),	...	29
coriaceum (Dirrhopalum),	...	158
Cornacuspongiæ,	...	x
corticata (Latrunculia),	...	234, 240
corticata (Polymastia),	XLII., XLIV.	**211**, 242, 256, 261
corticocancellata (Cladorhiza),	...	89, 91
cratera (Latrunculia),	...	233, 234, 237, 239
crateriformis (Reniera),	...	13
cratitius (Rhaphidophlus),	...	151
Crella,	...	115
cretacea (Cribrochalina),	...	18
Cribrella,	...	136
cribrigera (Myxilla),	XXVII.	xl, 132, **135**, 141, 248, 254
Cribrochalina,	...	18, 172
crinita (Chondrocladia),	XX., XXI.	l., 94, **101**, 247, 253, 261
Crinorhiza,	...	88
Crinorhiza forms,	...	l, liii, 87, 92, 93, 94, 96, 97, 99, 101, 218, 262
Crustaceans (infesting sponges),	...	xxviii, 8
cunctatrix (Spirastrella),	...	229, 231
cunninghami (Esperia),	...	67
cylindrica (Esperiopsis),	XIX.	**79**, 245, 253
cylindricus (Iophon),	XVI., XVII.	117, **120**, 121, 245, 254
cylindrifera (Suberites ramulosus, var.),	XXIX., XLIII.	xxxii, **208**, 247, 256
Dactylocalycidæ,	...	viii
Dasychalina,	...	19
decumbens (Clathria),	...	**148**, 246, 254
decumbens (Spirastrella),	XLV.	**229**, 247, 256
Demospongiæ,	...	xi
Dendrilla,	...	xxiii, xxiv
Dendropsis,	XXXVIII., XL., XLVI.	xvii, lix, **191**, 243, 256, 259
Desmacella,	...	lviii, lxv, 43, **58**, 241, 252
Desmacellina,	...	58
Desmacellinæ,	...	lviii, lxiv, lxv, 58
Desmacidinæ,	...	ix

	Plate	Page
Desmacidon,	xxii., xxiii., xxiv., xxix., xxx., xlvii.	xx, xxviii, xxxvii, lix, lxiv, lxvi, 32, 74, **103**, 108, 145, 242, 243, 244, 245, 253, 254
Desmacidonidæ,		viii, x, xviii, xxxiii, lv, lvi, lvii, lix, lx, lxi, lxiii, lxiv, lxv, lxvi, **62**, 193, 218
Desmacodes,		37, 38, 44, 58
dickiei (Hastatus),		129
Dictyocylindrus,		liv, 189
Dictyonina,		xi
diffusa (Cladochalina),		22
diffusa (Pachychalina),		22
digitata (Myxilla),	xxvi., xxvii.	129, **131**, 243, 254
digitata (Reniera),		51
digitata (Spongia),		109
digitata (Tedania),	xi.	**51**, 241, 245, 252, 260
Dirrhopalum,		157, 158
dissimilis (Cliona),	xxv., xxix.	xlii, **227**, 246, 256
domuncula (Suberites),		xlv
Donatiadæ,		viii
dura (Petrosia),		12
dura (Reniera),		17
durissimus (Suberites),	xli., xlv.	**203**, 244, 256
Dysidea,		lxi
Dysideidæ,		vii
Eccœlonida,		227
echidnæa (Axinella),	xxxvi.	**183**, 242, 255
echidnæa (Spongia),		183
Echinoclathria,	xxix., xxxi.	xxv, lv, lix, **159**, 178, 245, 255
Echinoderms,		96
Echinodictyum,	xxxii.	lix, **164**, 246, 248, 255
Echinonema,		151, 152, 153
Echinonemata,		vi, ix, lxvii
Ecionemia,		liv
Ectyon,		163, 164
Ectyonida,		ix, **128**
Ectyonidæ,		x, lxvi
Ectyoninæ,		xxv, liv, lix, lxvi, lxvii, lxviii, **128**, 260
edwardi (Amphilectus),		78
edwardii (Esperiopsis),	xix.	77, **78**, 249, 253
edwardii (Esperiopsis, var. americana),		78
edwardii (Isodictya)		78
elegans (Plocamia coriacea, var.),	xxix., xxxi.	**158**, 241, 255
elegantula (Clathria),	xxviii., xxix.	9, **149**, 245, 255
elliptica (Melonanchora),		xx
elongata (Pachychalina),	vi.	**23**, 244, 251
elongata (Suberites),		205
elongata (Thecophora),		221
elongatus (Suberites),	xliii.	xxvi, **205**, 241, 256
erecta (Axinella),	xxxv., xxxvi., xl.	170, 180, 182, 242 243, 244, 255, 261
erecta (Hymeraphia vermiculata, var.),		182
Esperella,	xiii., xiv., xv., xvi., xlviii.	xviii, xx, xxv, xxviii, xxix, xxx, xxxi, xxxiii, xxxiv, xxxvii, xxxviii, xxxix, xliii, xliv, xlv, xlvi, xlvii, xlviii, l, li, lii, lv, lvi, lix, lxv, lxvi, 40, 56, 61, **62**, 77, 78, 90, 96, 119, 198, 242, 243, 244, 245, 246, 247, 248, 249, 250, 252, 253, 259, 261
Esperellinæ,		xxiv, lix, lxii, lxvi, lxvii, **62**, 129
Esperia,		xlix, lii, 62, 64, 65, 66, 67, 77, 78, 117
Esperiadæ,		viii
esperii (Myxilla),		130
Esperina,		62
esperioides (Vomerula),	xii., xvii.	xxviii, xxxvii, **60**, 74, 243, 250, 252
Esperiopsis,	xviii., xix., xxvi., xxx., xlvi.	xxii, xxiii, xxxiii, xli, xliii, xlv, xlviii, lix, **76**, 124, 133, 243, 245, 246, 247, 248, 249, 253, 261, 262
Euplectella,		210, 226
Euplectelladæ,		viii
Euspongia,		lii, lxi, 125
Farreadæ,		viii
fasciculata (Myxilla),		130
favus (Echinoclathria),	xxxi.	xxv, **160**, 162, 245, 255
fenestratus (Leucophlœus),		169
fertilis (Chalinula),		lii
fibrosa (Axinella),	xxxvii.	lv, **183**, 249, 255
fibrosa (Dasychalina),		21
fibrosa (Pachychalina),	iv.	xlviii, **21**, 242, 247, 251
fibrosa (Tedania digitata, var.),		**51**, 245, 252
Fibularia,		37, 47
fibulata (Axos),		47
fibulata (Gelliodes),	xii.	**47**, 246, 252
fibulata (Rhizochalina),		37
fibulatus (Desmacodes),		38
Fibulia,		37
filifer (Rhaphidophlus),	xxviii., xlvi.	**152** 247, 255

	Plate	Page
filigrana (Reniera),	...	1, lii
finitima (Chalina),	...	28, 29
fistulatus (Suberites),	... ...	126
fistulosa (Desmacidon),	...	32
fistulosa (Rhizochalina),	VIII., IX.	6, **32**, 34, 35, 241, 246, 252
flabellata (Phakellia),	XXXIV., XL.	xl, xli, xlviii, **171**, 245, 255, 259
flabelliformis (Gellius),	XXVI.	xli, 38, **45**, 250, 252, 259
flagellifer (Gellius),	XIII.	**42**, 243, 252
flagelliformis (Raspailia),	XXXIX.	**190**, 191, 243, 256
Foliolina,	...	82
Foraminifera (in a sponge),	...	137, 185
Forcepia,	...	xviii
forcipis (Halichondria),	...	xviii, 136
fragilis (Dasychalina),	...	20
fragilis (Pachychalina),	IV.	**20**, 21, 247, 251
frondifer (Amphilectus),	...	149
frondifer (Clathria),	...	**149**, 160, 178, 246, 254
frondifera (Halichondria),	...	149
frondosa (Myxilla),	XXVI., XXVII.	xxxvii, xli, lxviii, **144**, 146, 147, 245, 254
fruticosa (Desmacidon),	XXIII., XXX.	**104**, 105, 245, 253
fruticosa (Halichondria),	...	104
fruticosa (Spongia),	...	104
funiformis (Thrinacophora),	XXIII., XXIV.	xvii, 193, **195**, 242, 256
fusca (Esperella),	XIV., XV.	xlv, **72**, 242, 253
fusca (Myxilla),	XXVII.	**136**, 138, 244, 254
fusifera (Myxilla (?) plumosa, var.),	...	**145**, 242, 254
gelatinosa (Esperella),	XVI.	xxx, xlv, **66**, 246, 253
gelatinosa (Esperia),	...	66
Gelliadæ,	...	viii, 37
Gelliina,	...	37
Gelliinæ,	...	lviii, lxiv, lxv, **37**
Gelliodes,	X., XII., XLVII.	lv, lviii, lxi, lxiii, **47**, 242, 245, 246, 252
Gellius,	VIII., XIII., XXVI.	xli, xlii, lv, lviii, lxiv, 36, **37**, 58, 241, 243, 244, 247, 249, 250, 252, 259
Geodia,	...	liv
Geodiadæ,	...	viii
Geodinidæ,	...	ix
glabra (Echinoclathria),	XXIX., XXXI.	**163**, 245, 255
glacialis (Gellius),	VIII., XIII.	41, 42, 243, 252
globosa (Stylocordyla stipitata, var.),	XLIII., L.	xxvi, xxx, xxxi, xxxii, xxxvii, xliii, xlv, xlvi, xlvii, 206, **224**, 243, 244, 256
gracilis (Amphilectus),	...	78
gracilis (Echinoclathria),	...	160
gracilis (Echinonema),	...	152
gracilis (Isodictya),	...	78
gracilis (Rhaphidophlus),	...	**152**, 242, 255
grandis (Desmacidon (Homœodictya)),	XXII., XXIX.	xlviii, 106, 109, **111**, 243, 254
Grantiadæ,	...	viii
Gummineæ,	...	ix
Gumminida,	...	ix
Halicnemia,	...	liv
Halichondria,	I., II., XLVI.	xviii, xxv, xxxiii, xxxviii, xl, xliii, xliv, xlv, xlviii, lii, lvi, lviii, **1**, 38, 39, 44, 59, 103, 108, 117, 134, 136, 145, 149, 156, 197, 243, 244, 245, 246, 247, 248, 249, 250, 251, 259, 260
Halichondriadæ,	...	vii, viii
Halichondridæ,	...	x
Halichondrina,	...	x, xxiv, xxv, xxxiii, xxxiv, xxxvi, xlii, xliii, xliv, xlv, xlvii, xlix, lii, liv, lv, lviii, lx, lxi, lxii, lxviii, **1**
Halicnemia,	...	218
Haliphysema,	...	liv, 156
Halisarca,	...	1
Halisarcida,	...	ix
Halisarcinæ,	...	ix
Halisarcosa,	...	xi
Hamacantha,	...	xxviii, lxvi, 58, 59, 60, 61, 74
Hamacanthidæ,	...	viii, 59
Hamacanthinæ,	...	xviii, lviii, lxiv, lxv, **59**
hamigera (Cribrella),	...	136
Hamispongia,	...	viii
hastata (Myxilla),	XXVII.	**134**, 250, 254
Hastatus,	...	128, 129
hemisphæricum (Trichostemma),	...	xlv, 216, 217, 219
Heterocœla,	...	x
Heterorrhaphidæ,	...	xxiv, liv, lvi, lviii, lxi, lxiii, lxiv, lxvi, **31**
Hexactinellida,	...	vi, ix, x, xi
Hexactinellidæ,	...	vi, ix
Higginsia,	...	192
Hircinidæ,	...	vii
Hircinida,	...	ix
hispida (Petrosia),	II., III.	xxxvii, xlv, xlviii, **14**, 244, 251

	Plate	Page
hispidus (Dictyocylindrus),	...	189
Histoderma,	...	115
Holoraphidota,	...	vi, ix
Homocœla,	...	x
Homœodictya,	xxii., xxiii., xxiv., xxix.	xxxvii, xlviii, lix, lxiii, 27, 104, 106, **108**, 243, 244, 254
Homorrhaphidæ,	...	xxiv, liv, lvi, lviii, lxi, lxiii, lxiv, lxv, **1**
horrida (Rhaphidophlus) lobatus, var.,	xxviii., xxix.	**153**, 243, 255
hyalina (Hymeniacidon?),	xlv.	**168**, 249, 255
hyaloderma (Ciocalypta),	xxxiii.	173, **174**, 176, 250, 255, 259
Hyalonema,	...	222, 223
Hyalospongiæ,	...	x
Hyalothaumadæ,	...	viii
Hymedesmia,	...	liv, 59, 61, 129
Hymeniacidon,	xxxiii., xxxix., xl., xlv.	xlv, lix, 129, 131, 143, 145, 156, **166**, 197, 227, 242, 247, 249, 255
Hymeraphia,	...	liv, 182
Hymerrhaphia,	...	129
hyndmani (Alebion),	...	117
hyndmani (Esperia),	...	117
hyndmani (Halichondria),	...	117
ibla (Thecophora),	...	221, 222
implexa (Reniera),	i.	**15**, 241, 251
inanchorata (Clathria),	xxviii., xxix.	147, 150, 245, 255
infundibuliformis (Isodictya),	...	172
infundibularis (Reniera aquæductus, var.),	i., ii.	**16**, 249, 251
infundibuliformis (Tedania),	xi., xxix.	xlviii, 50, **54**, 56, 249, 252
intermedia (Siphonochalina),	vii., xlvi.	**30**, 31, 245, 252, 259
inversa (Cladorhiza),	xx., xxi.	93, **94**, 250, 253, 261
Iophon,	xvi., xvii.	xxi, xxviii, lix, lxi, lxv, **116**, 137, 242, 243, 244, 245, 249, 254, 260
irregulare (Trichostemma),	xliii.	219, **220**, 248, 256, 261.
Isodictya,	...	lxiv, 14, 36, 38, 39, 78, 108, 109, 158, 172
isodictyalis (Halichondria),	...	134
Isopod (infesting sponge),	...	40
japonica (Myxilla rosacea, var.),	xxvi., xxvii., xlvii.	xxvi, xxvii, xxxvii, 129, **130**, 140, 247, 254
jeffreysii (Biemna),	...	36
jeffreysii (Desmacidon),	...	lxiv, 32, **36**
jeffreysii (Oceanapia),	...	36
johnsoni (Hamacantha),	...	xxviii, 60, 61, 74
johnsoni (Hymedesmia),	...	59, 61
Keratosa,	...	vii, viii, xi, lv, lvi, lx, 257
Keratospongia,	...	vii
kerguelenensis (Desmacidon (Homœodictya)),	xxiii., xxiv.	xxxvii, 109, **110**, 112, 244, 254
lacustris (Spongilla),	...	xvii, 193
lævis (Gellius),	xiii.	**40**, 250, 252
laminalis (Iophon),	xvi., xvii.	120, **121**, 243, 254
Lanuginellidæ,	...	viii
lanugo (Esperia),	...	65
lapidiformis (Esperella),	xv., xvi., xlviii.	xxx, xxxi, xxxvii, xxxix, xlv, xlviii, l, lii, **64**, 250, 252, 259
Latrunculia,	xxix., xliv., xlv., li.	xxi, xxvii, xxviii, xxxii, xxxviii, xxxix, xliii, xliv, xlv, xlvi, xlvii, xlviii, lix, lxii, lxviii, 7, 231, **233**, 242, 244, 250, 257, 259, 260
latrunculioides (Halichondria),	i., ii., xlvi.	xxxviii, xl, xlviii, **6**, 250, 251, 259
leei (Ciocalypta),	...	173, 174
Leiospongia,	...	vii
lendenfeldi (Clathria),	xxviii., xxix., xlvii.	xxv, **148**, 245, 254
Leucophlœus,	...	169
licheniformis (Geliodes),	xii., xlvii.	47, **48**, 242, 252
licheniformis (Spongia),	...	48
limbata (Chalina),	...	28
linearis (Cladorhiza abyssicola, var.),	...	**90**, 248, 253
lingua (Esperella),	...	xxxix
Lithistida,	...	xi
Lithistidæ,	...	vi, ix
Lithistina,	...	x
litoralis (Reniera),	...	18
lobata (Clathria),	...	153, 154
lobata (Pachychalina),	v., xlvi.	xxx, xxxviii, **22**, 245, 251
lobata (Spongia),	...	22
lobatus (Rhaphidophlus), var. horrida,	xxviii., xxix.	**153**, 243, 255
lobularis (Halisarca),	...	l
lobularis (Oscarella),	...	l
longipinna (Cladorhiza),	xx., xxi.	**92**, 93, 248, 253, 260, 261
Lophurellidæ,	...	viii
lovenii (Podospongia),	...	234
Luffarida,	...	ix

	Plate	Page
lunæcharta (Axinella ?),	xxxvii.	**186**, 188, 242, 255
luridus (Hastatus),	...	129
Lyssakina,	...	xi
Macandrewiadæ,	...	viii
magellanica (Esperella),	...	**67**, 249, 253
magellanica (Esperia),	...	67
magellanica (Gellius carduus, var.),	xiii.	**40**, 249, 252
mammiformis (Esperella),	xiv., xv.	xx, xxxvii, xxxix, l, li, **63**, 96, 198, 243, 252, 261
mammillaris (Polymastia),	...	211, 214
mammillata (Plumohalichondria),	xxx., xlvii.	xxvii, **156**, 245, 255
mariana (Axinella),	xxxiv., xl.	**180**, 243, 255
mariana (Myxilla),	xxvii.	xl, lxiii, **137**, 243, 249, 254
massa (Fibularia),	...	47
massa (Myxilla mariana, var.),	xxvii.	xl, **138**, 249, 254
massa (Petrosia) similis, var.,	ii., iii.	**11**, 249, 251
massa (Spirastrella),	xlv.	xxx, xlv, **230**, 245, 256
massa (Tedania),	xi., xxiii.	**53**, 55, 56, 245, 249, 250, 252, 259
mastophora (Axinella),	...	182
mauritianus (Agelas),	xxix.	**164**, 242, 255
mauritianus (Ectyon),	...	164
meangensis (Esperiopsis challengeri, var.),	...	**82**, 247, 253
megalirrhaphis (Amorphina),	...	2
megalorhaphis (Amorphina),	...	2
megalorrhaphis (Amorphina),	...	2
megalorrhaphis (Pachychalina),	v.	**23**, 245, 251
Meliiderma,	xx., xxi.	xx, xxvii, 97, **102**, 243, 253, 261
melior (Dasychalina),	...	21
melior (Pachychalina),	iv.	**20**, 247, 251
Melonanchora,	...	xx
Microciona,	...	liv, 110, 139, 145, 156
microcionides (Plumohalichondria),	...	156
microstomus (Suberites),	xli.	**199**, 244, 256
mirabile (Axoniderma),	xx.	xxii, 87, 93, **97**, 248, 253, 261
mirabile (Trochoderma),	...	97
mollis (Myxilla),	xxvii.	**133**, 134, 249, 254
mollis (Suberites),	xli., xlv.	**204**, 244, 256
Monactinellidæ,	...	vi, ix, 1
Monaxona,	...	xi
Monaxonia,	...	xi
Moxanonida,	...	i, vi, xi, lviii, **1**
Monaxonidæ,	...	1

	Plate	Page
monticularis (Axinella),	xxxviii.	**185**, 242, 255
moruliformis (Cladorhiza),	xx., xxi.	87, **90**, 244, 253, 261
muggiana (Reniera),	...	51
murrayi (Esperella),	xiii., xiv., xlviii.	xxviii, xxix, xxx, xxxi, xxxiv, xxxviii, xxxix, xliii, xliv, xlv, xlvi, xlvii, xlviii, l, 56, 63, 65, **67**, 119, 245, 253, 259
muta (Bursalina),	...	226, 227
Myxilla,	xxvi., xxvii., xxx., xlvii.	xxvi, xxvii, xxxvii, xl, xli, xlii, xliii, xliv, xlv, li, lv, lix, lxiii, lxv, lxvii, lxviii, 84, **128**, 147, 242, 243, 244, 245, 246, 247, 248, 249, 250, 254
Myxospongiæ,	...	vi, xi
navicelligera (Crella),	...	115
navicelligerum (Sideroderma),	viii., ix.	xix, **115**, 246, 254
nervosum (Echinodictyum),	...	165
nigricans (Esperia),	...	117
nigricans (Halichondria),	...	117
nigricans (Iophon),	...	117
nivea (Gellius glacialis, var.),	viii. xiii.	42, 243, 252
nobilis (Myxilla),	xxvii., xxx.	xl, xliii, xlv, li, 137, **140**, 143, 244, 250, 254
nobilis (Myxilla), var. bacillifera,	xxvii.	**142**, 248
nobilis (Myxilla), var. patagonica,	xxvii.	**142**, 249
nodosa (Echinoclathria),	...	160
Non-calcarea,	...	x
normani (Isodictya),	..	109
nuda (Esperella),	xv., xvi.	65, **70**, 242, 253
obtusa (Acanthella),	...	177
Oceanapia,	ix.	lviii, lxiv, 32, **36**, 242, 252
oculata (Spongia),	...	26
officinalis (Euspongia),	...	lii
oleracea (Rhizochalina),	...	lxiv, 36
Oligosilicina,	...	x
omnivorus (Iophon ?),	xvii.	lxi, **122**, 254, 254
Ophistospongiadæ,	...	vii, viii
Ophlitaspongia,	...	vii
Oscarella,	...	1
Oscillatorian Alga (parasitic),	...	3
Pachastrellida,	..	ix

	Plate	Page
Pachychalina,	IV., V., VI., XLVI.	xxx, xxxviii, xlviii, lviii, **19**, 153, 242, 244, 245, 247, 251
Pachymatisma,	...	liv
Pachytragida,	...	ix
palmata (Chalina),	V.	**26**, 246, 251
palmata (Desmacidon (Homœodictya)),	...	109, 110, 111
palmata (Halichondria),	...	108, 109
palmata (Homœodictya (Chalina)),	...	108
palmata (Isodictya),	...	108, 109
palmata (Spongia),	...	26, 27, 108
Pandaros,	...	176
panicea (Amorphina),	...	2
panicea (Halichondria),	II.	xliii, xlv, **2**, 5, 15, 244, 247, 251, 260
papillata (Hamacantha),	...	61
Papillina,	..	58
papillosa (Spirastrella),	XLI., XLV.	xlviii, **232**, 245, 257, 259
papyracea (Phakellia),	XXXVI.	**172**, 243, 244, 255
paradoxa (Axinella ?),	XXV., XLIX.	xxii, xxiii, xxx, xxxiv, xlv, xlvi, **187**, 242, 256
parasitica (Esperella),	...	lxi
parishi (Esperia),	...	65
parishii (Amphilectus),	...	65
parishii (Esperella),	...	**65**, 247, 253
parishii (Raphiodesma),	...	65
patagonica (Myxilla nobilis, var.),	XXVII.	**142**, 254
patagonica (Trachytedania),	XXIII.	**57**, 249, 252
patelliformis (Xenospongia),	...	218
patera (Halicnemia),	...	218
pattersoni (Esperia),	...	117
pattersoni (Halichondria),	...	117
pattersoni (Iophon),	...	116, **117**, 242, 249, 254, 260
Patuloscula,	...	29
paucispinata (Myxilla),	XXVII., XXX.	84, **132**, 141, 246, 254
paupera (Isodictya),	...	78
paupertas (Hymeniacidon),	...	129, 131, **143**
paupertas (Myxilla),	...	129, 131, 137, **143**
Pecten (encrusted by sponges),	...	27, 66, 161
pedunculata (Pachychalina ?),	V.	**25**, 244, 251
pedunculata (Rhizochalina),	VIII, IX.	34, **35**, 245, 252
pelliculata (Halichondria),	I., II.	**5**, 246, 251
Pellina,	...	15
peltata (Foliolina),	...	82
penicillus (Ciocalypta),	...	173, 174, 175, 176
pennatula (Cladorhiza),	...	76, 86, 89
perfectus (Suberites),	XLI., XLV., L.	xxii, xxiii, xxiv, xxxi, **200**, 202, 245, 256
pergamentacea (Chalina),	V.	26, **27**, 244, 251, 260
pergamentacea (Cladochalina),	...	27
Petrosia,	II., III.	xxxvii, xlv, xlviii, liii, lviii, 4, 6, **9**, 20, 243, 244, 247, 249, 251
Phakellia,	XXXIV., XXXV., XXXVI., XL., XLIX.	xxx, xxxiii, xl, xli, xlii, xliii, xlv, xlvi, xlviii, liv, lvi, lix, 54, **169**, 242, 243, 244, 245, 249, 255, 259, 261
Phakelliadæ,	...	vii, viii
Phelloderma,	XXIII., XLVII.	xxxiii, lv, lix, lx, 85, **113**, 250, 254, 259
Phlœodictyina,	...	lxiv, **31**
Phlœodictyinæ,	...	lviii, lxiv, lxv, **31**
Phlœodictyon,	...	32, 34
Phoriospongia,	...	lxi, 73, 123
Phoriospongiæ,	...	xxviii
Phyllospongia,	...	xlviii
piceum (Iophon (Alebion)),	...	117, 118, 120, 121
pilosus (Amphilectus),	XIX., XXV.	xviii, **126**, 243, 244, 254
Placospongiadæ,	...	viii
Plethospongiæ,	...	xi
Plocamia,	XXIX., XXXI.	lix, **157**, 241, 255
Plumohalichondria,	XXX., XLVII.	xxvii, lix, 129, 145, 146, 150, **155**, 242, 245, 255
Plumohalichondrina,	...	155
plumosa (Desmacidon),	..	145
plumosa (Halichondria),	...	156
plumosa (Halichondria ?),	...	145
plumosa (Hymeniacidon),	..	145, 156
plumosa (Microciona),	...	145
plumosa (Myxilla),	..	**145**, 242, 254
plumosa (Myxilla ?), var. fusifera,	...	145
plumosa (Plumohalichondria),	...	145, 242
plumosa (Pronax),	...	145
plumosa (Spongia),	...	145
poculum (Gelliodes),	X.	47, **48**, 245, 252
Podospongia,	..	234
Polychæte worms (living in sponge),	...	132

	Plate	Page
Polymastia,	xli., xlii., xliv.	xxviii, xlv, xlvi, xlvii, liv, lix, lxi, 197, **210**, 218, 222, 223, 225, 226, 241, 242, 256, 261
Polymastiadæ,	...	vii, viii
Polymastidæ,	...	x, lxviii
Polyzoa,	...	88
Porifera,	...	vi, vii, x, xi
Poriphora,	...	vii
porosa (Esperella),	xv., xvi.	**69**, 71, 245, 253
Potamospongia,	...	viii
Potamospongida,	...	ix
profunda (Axinella),	xxxviii., xl.	**181**, 247, 248, 255, 260, 261, 263
profunda (Esperiopsis),	xix.	78, **83**, 243, 253, 261
Pronax,	...	145
Proteleia,	xlii., xliv.	lix, lx, **214**, 243, 256, 259
proteus (Leucophlœus),	...	169
proximum (Alebion),	...	117
Psammonemata,	...	vi, ix
Pseudoceratida,	...	ix
Pseudochalinida,	...	ix
Pseudohircinida,	...	ix
Pseudotetraxonia,	...	x
Pteronemadæ,	...	viii
pulchella (Esperiopsis),	xix., xxx.	**84**, 133, 246, 253
pulcherrima (Acanthella),	xxxii.	xxii, xxiii, **177**, 246, 255
pumilio (Desmacella),	...	58, 59
punctata (Pachychalina?),	vi., xlvi.	xlviii, **24**, 244, 251
purpurea (Latrunculia),	...	234, 240
putridosa (Rhizochalina),	viii., ix.	32, **33**, 242, 244, 245, 252
putridosum (Alcyonium),	...	33, 34
Quasillina,	...	lix, **225**, 241, 256
radiatum (Phelloderma),	xxiii., xlvii.	85, **113**, 250, 254, 259
Radiella,	...	216, 217, 218
ramosa (Desmacidon?),	xxiii., xxiv., xlvii.	**107**, 243, 253
ramulosa (Suberites),	...	207
ramulosus (Suberites),	xxix., xliii.	xxxii, 197, **207**, 222, 225, 246, 247, 256
Raphidonemata,	...	vi, ix
Raphioderma,	...	62
Raphiodesma,	...	62, 65
Raphiophoridæ,	...	vii, viii
Raspailia,	xxxix., xl., xlix.	xxii, xxiii, xxxiii, xlv, lix, 80, 107, 164, 178, **188**, 242, 243, 256
Raspelia,	...	188
rectangularis (Chalina),	v., xlvi.	26, 27, 247, 251
rectangularis (Cladorhiza abyssicola, var.),	...	86, **88**, 248, 253
regalis (Sceptrella),	...	lxii, lxvi, 234
Reniera,	i., ii.	xxv, xxxvii, xliv, xlv, xlix, l, lii, lviii, 1, 9, 13, **14**, 50, 51, 167, 241, 242, 247, 248, 249, 251, 260
Renierida,	...	ix
Renierina,	...	1
Renierinæ,	...	ix, liv, lvi, lviii. lx, lxiii, lxv, **1**, 20, 25, 167
repens (Thalysias),	...	10
reptans (Desmacidon),	xxiii.	xxviii, **105**, 242, 253
reticulata (Axinella),	xxxvii.	**184**, 242, 255
Rhaphidophlus,	xxviii., xxix., xlvi.	lix, 146, **151**, 242, 243, 247, 255
Rhizaxinella,	...	222
Rhizochalina,	viii., ix.	lviii, lxiv, 6, **32**, 241, 242, 244, 245, 246, 252
rigida (Raspailia?),	xxxix.	**191**, 243, 256
Rinalda,	...	210
robusta (Euplectella),	...	210
robusta (Isodictya),	...	lxiv, 36
robusta (Oceanapia),	ix.	lxiv, 32, **36**, 242, 252
robusta (Phakellia),	...	170
robusta (Polymastia),	xli.	**210**, 214, 226, 241, 256
robusta (Toxochalina),	...	**50**, 242, 252
robustus (Gellius),	...	36
rosacea (Halichondria),	...	130
rosacea (Myxilla),	xxvi., xxvii., xlvii.	xxvi, xxvii, xxxvii, 128, 129, **130**, 140, 141, 247, 254
rosea (Dendrilla),	...	xxiv
rotalis (Desmacidon),	...	74
rotalis (Esperella),	...	74
rubens (Spongia),	...	19
rubispina (Spongia),	...	47
rugosa (Axinella),	...	182
rugosa (Halichondria solida, var.),	...	**4**, 245, 251
rugosum (Echinodictyum),	xxxii.	**165**, 246, 255
rustica (Pachychalina),	...	19
Sarcohexactinellida,	...	ix
Sarcovitreohexactinellida,	...	ix
sarsii (Trichostemma),	xliii.	217, **218**, 241, 245, 256, 261
scandens (Esperia),	...	117
scandens (Halichondria),	...	117
scandens (Iophon),	...	117
Sceptrella,	...	lxii, lxvi, 233, 234
Schmidtia,	...	**9**, 10, 12

	Plate	Page
semisuberites (Tentorium),	L.	xxix, xxxi, xxxviii, **xl**, xliii, xliv, xlv, 198, 199, **221**, 241, 242, 256, 260, 261
semisuberites (Thecophora),	...	221, 222
semitubulosa (Reniera),	...	xlix, 15
senilis (Suberites),	XLV.	**209**, 247, 256, 261
Sideroderma,	VIII., IX.	xix, lix, **114**, 246 254
Silicea,	...	vii, viii, liv
similis (Cladorhiza),	XX., XXI.	**93**, 95, 98, 248, 253, 261
similis (Petrosia),	II., III.	liii, **9**, 243, 244, 247, 249, 251
simonis (Esperella),	XV.	xxviii, xxxvii, lxv, lxvi, **73**, 243, 253
simulans (Halichondria),	...	lii
singaporense (Phlœodictyon),	...	34
singaporensis (Rhizochalina),	...	**34**, 36, 242, 252
Siphonochalina,	VII., XLVI.	xlviii, lviii, **29**, 49, 244, 245, 252, 259
sol (Radiella),	...	217
solida (Halichondria),	II.	xxv, **4**, 245, 248, 251
solida (Spirastrella),	XLI., XLV.	xlvii, xlviii, lxi, **231**, 247, 256
sollasi (Proteleia),	XLII., XLIV.	**214**, 243, 256
sparsus (Ectyon),	...	163
Sphærospongia,	...	viii
Spiculispongiæ,	...	x
spinata (Trachytedania),	...	57, 58
Spinosella,	...	20, 29
spiralis (Suberites),	XXV.	**206**, 249, 256
Spirastrella,	XLI., XLV.	xxi, xxvii, xxviii, xxx, xxxiii, xlv, xlvii, xlviii, lvi, lix, lxi, lxviii, **229**, 245, 247, 256, 257, 259
Spirastrellidæ,	...	lix, lx, lxi, lxii, lxviii, 229
Spongiadæ,	...	vii
Spongia,	...	15, 19, 22, 26, 30, 47, 48, 108, 109, 145, 172, 177, 183
Spongiæ,	...	vi
Spongida,	...	ix
Spongidæ,	...	1
Spongilla,	...	xvii, 192, 193
Spongilladæ,	...	viii
Spongillidæ,	...	x, lxiii
spongiosa (Myxilla),	XXVII.	**134** 135, 250, 254
Sporadopora (encrusted by sponge),	...	113, 199
stipitata (Acanthella?),	...	**178**, 246, 255
stipitata (Chondrocladia),	...	102
stipitata (Polymastia),	...	223
stipitata (Stylocordyla),	XLIII., L.	xxvi, xxx, xxxi, xxxii, xxxvii, xliii, xlv, xlvi, xlvii, 206, **223**, 241, 242, 243, 244, 256, 261
stipitata (Stylorhiza),	...	223
stipitata (Meliiderma),	XX., XXI.	xx, **102**, 243, 253, 261
stolonifera (Esperia),	...	64
Stylocordyla,	XLIII., L.	xxvi, xxvii, xxx, xxxi, xxxii, xxxiii, xxxvii, xliii, xlv, xlvi, xlvii, xlviii, lvi, lix, lxviii, 197, 204, 206, 207, **222**, 241, 242, 243, 244, 256, 261, 262
Stylorhiza,	...	222, 223
subacerata (Hymeniacidon ?),	XXXIX., XL.	**168**, 247, 255
suberea (Papillina),	...	58
subereus (Desmacodes),	...	58
Suberispongia,	...	vii
Suberites,	XXV., XXIX., XLI., XLIII., XLV., L.	xxii, xxiii, xxiv, xxvi, xxvii, xxx, xxxi, xxxii, xliii, xlv, lix, lxii, lxviii, 125, 126, 168, 191, **197**, 222, 225, 241, 242, 243, 244, 245, 246, 247, 249, 250, 256, 259, 260, 261
Suberitida,	...	ix
Suberitidæ,	...	vii, viii, x, xxvi, xxix, xxxiii, xliii, xliv, xlv, liv, lix, lx, lxi, lxii, lxvii, lxviii, **197**
Suberitidinæ,	...	ix
suberitoides (Artemisina),	...	**112**, 124, 125, 241, 254
subglobosa (Reniera),	I., II.	xxxvii, **17**, 248, 251
subhispida (Echinoclathria,),	...	160
subtriangularis (Petrosia),	...	11
subtriangularis (Thalysias),	...	9, 10
suctoria (Tedania),	...	52
sycinularia (Auletta),	...	187
symmetrica (Esperiopsis),	XIX., XXVI., XLVI.	**77**, 243, 253

	Plate	Page
Tedania,	xi., xxiii., xxix.	xvii, xxvii, xli, xlviii, lviii, lxi, **50**, 57, 133, 139, 241, 244, 245, 248, 249, 250, 252, 259, 260, 261, 262
Tedaniina,	...	50
Tedaniinæ,	...	lviii, lxiv, lxv, **50**
Tenacia,	...	146, 147
tenda (Vomerula),	...	59
Tentorium,	l.	xxix, xxxi, xxxii, xxxviii, xl, xliii, xliv, xlv, lix, 198, 199, **221**, 241, 242, 256, 260, 261, 262
tenuicapitata (Tedania),	xi.	**52**, 53, 54, 249, 252
tenuis (Echinoclathria),	...	160
tenuis (Raspailia),	xxxix., xl., xlix.	xxii, xxiii, xlv, **188**, 242, 256
ternatus (Acarnus),	...	148, **159**, 248, 255
Tethea,	...	liv
Tethyadæ,	...	viii, xxi, lx, lxviii
Tetractina,	...	x
Tetractinellida,	...	vi, xi, xxi, xxix, lx, lxviii, 193
Tetractinellidæ,	...	vi, ix
Tetraxonia,	...	xi
Thalassospongia,	...	vii
Thalysias,	...	9, 10
Thecophora,	...	221, 222
Theneadæ,	...	viii
Thrinacophora,	xxiii., xxiv., xxxvi., xl.	xvii, lix, lx, **193**, 242, 247, 256
tibicen (Vomerula),	...	lxvi
titubans (Desmacidon),	...	xx
Toxochalina,	...	lv, lviii, lxi, lxiii, 47, **49**, 242, 252
Trachytedania,	xxiii.	lviii, lxv, 50, **57**, 133, 249, 252
Trichostemma,	xliii.	xlv, lix, 197, 210, **216**, 241, 245, 248, 256, 261, 262
tridens (Myxilla),	...	130
tridentata (Cladorhiza ?),	xx., xxi., xlix.	xx, xxi, xxxiv, **95**, 243, 253, 261
triloba (Latrunculia),	...	234
triloba (Sceptrella),	...	234
Trochoderma,	...	96
truncata (Petrosia),	ii., iii.	4, **12**, 247, 251
Tuba,	...	29, 49
tuberculata (Ciocalypta),	...	173, **175**
tubulatum (Haliphysema),	...	156
tubulosa (Axinella ?),	xxxviii.	**187**, 250, 256
tubulosa (Siphonochalina),	...	31
tubulosa (Spongia),	...	30
tufa (Reniera),	i., ii.	**18**, 242, 251
tunicatum (Desmacidon),	...	lxvi
Turbinaria,	...	227
tyleri (Ciocalypta),	...	173
typicum (Echinonema),	...	153
vagabunda (Desmacella),	...	58, 59
vagabundus (Desmacodes), var. annexa,	...	59
vagabundus (Gellius),	...	43
varia (Halichondria),	...	38, 39
variabilis (Petrosia),	ii.	**13**, 247, 251
variabilis (Schmidtia),	...	12, 13
varius (Gellius),	viii.	**38**, 247, 252
velutata (Esperella),	...	70
ventilabrum (Halichondria),	...	170
ventilabrum (Phakellia),	xxxv., xlix.	xxx, xl, xli, xlv, xlviii, 54, **170**, 242, 249, 255, 261
vermiculata (Bubaris),	...	182
vermiculata (Hymeraphia),	...	182
vesiculifera (Cacospongia),	...	xxxiii
villosa (Aulena),	...	xxiv
villosa (Esperia),	...	77
villosa (Esperiopsis),	...	77
Vioa,	...	227
virgata (Chondrocladia),	...	86, 99
virgata (Isodictya),	...	38, 39
Vitreohexactinellida,	...	ix
Vomerula,	xii., xvii.	xxviii, xxxvii, lviii, lxvi, 58, **59**, 74, 243, 250, 252
Vomerulinæ,	...	59
warreni (Cliona),	...	229
Weberella,	...	xlvi, xlvii, 210
Xenospongia,	...	218
Xenospongiadæ,	...	viii

PLATE I.

PLATE I.

PAGE

Fig. 1. *Halichondria pelliculata*, seen from in front; *o*, oscula; natural size, . 5

Fig. 1*a*. Seen from behind; natural size.

Fig. 2. *Reniera aquæductus*, var. *infundibularis;* natural size, . . . 16

Fig. 3. *Reniera subglobosa;* natural size, ... 17

Fig. 3*a*. View of portion of the inside; natural size.

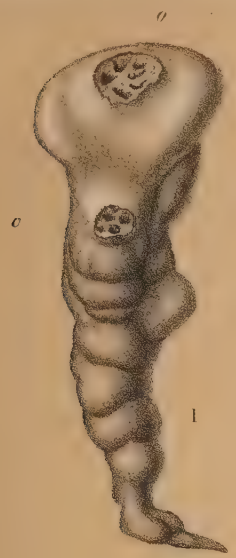
Fig. 4. *Reniera implexa*, var.; natural size, ... 15

Fig. 5. *Halichondria latrunculioides; o*, oscula; *p.a*, raised pore-areas; natural size, ... 6

Fig. 5*a*. One of the raised pore-areas; × 12.

Fig. 6. *Reniera tufa;* natural size, ... 18

Fig. 6*a*. Vertical section; natural size.



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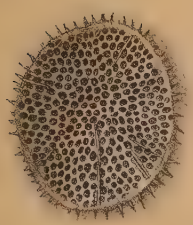

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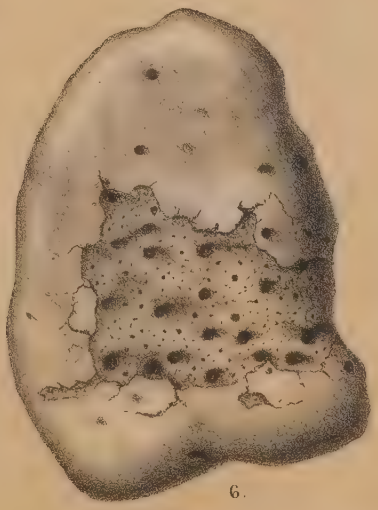

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HALICHONDRIA, RENIERA.

PLATE II.

PLATE II.

PAGE

Fig. 1. *Halichondria latrunculioides*, oxea; × 122, ... 7

Fig. 2. *Halichondria panicea* (Kerguelen), oxea; × 122, . . . 3

Fig. 3. *Halichondria panicea* (Japan), oxea; × 122, ... 3

Fig. 4. *Halichondria* (?) sp. (*c*), oxea; × 122, ... 8

Fig. 5. *Halichondria solida*, strongyla; × 122, ... 4

Fig. 5*a*. Three ends of spicules, showing irregularity in form; × 284.

Fig. 6. *Reniera subglobosa*, oxea; × 122, ... 17

Fig. 7. *Reniera tufa*, oxea; × 122, ... 18

Fig. 8. *Reniera aquæductus*, var. *infundibularis*, oxea; × 122, . . 16

Fig. 9. *Halichondria pelliculata*, oxea; × 122, ... 6

Fig. 10. *Petrosia similis*, oxea; × 122, ... 10

Fig. 11. *Petrosia similis*, var. *massa*, oxea; × 122, ... 11

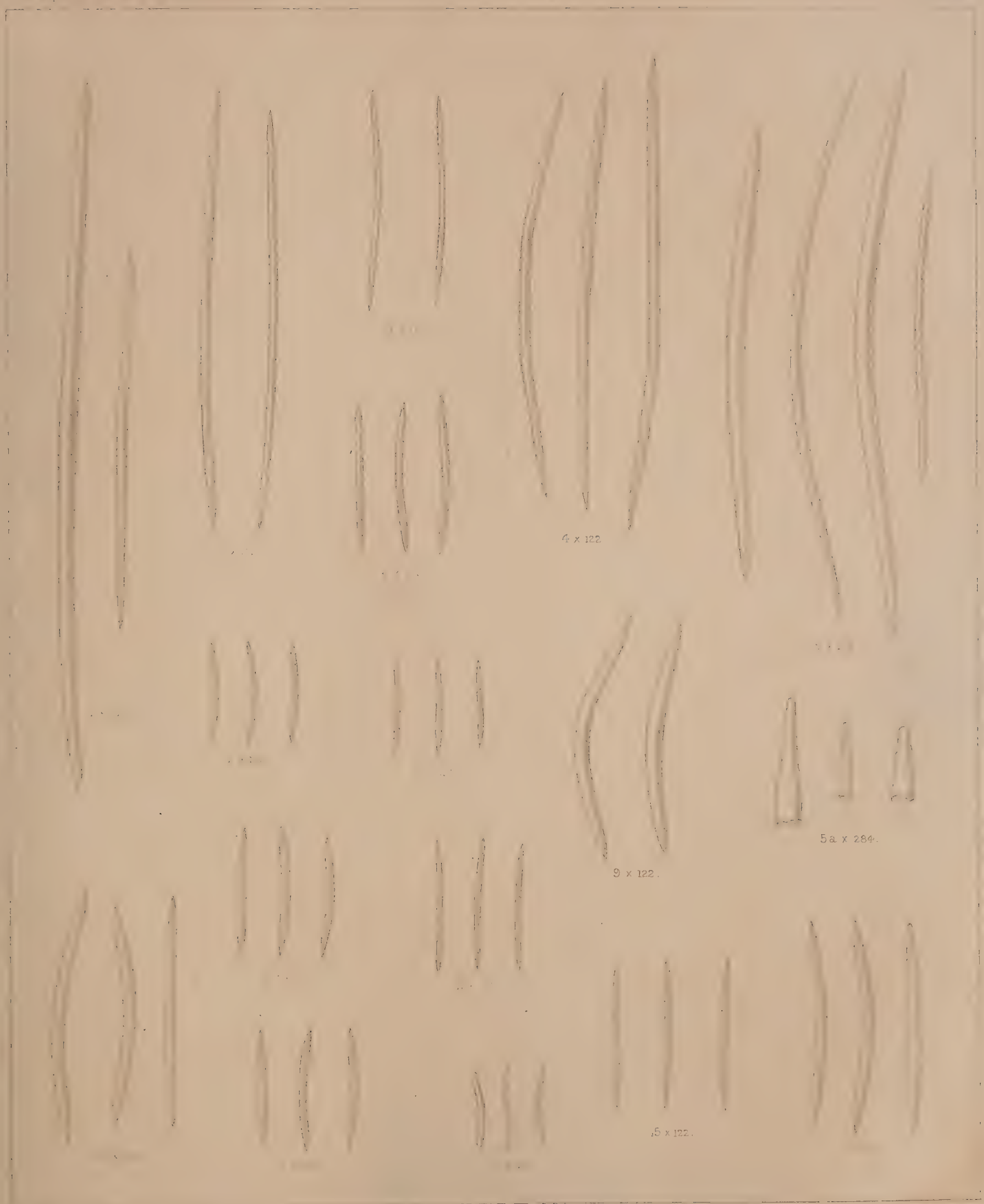
Fig. 12. *Petrosia variabilis*, var., oxea; × 122, ... 14

Fig. 13. *Petrosia similis*, var. *compacta*, oxea; × 122, ... 12

Fig. 14. *Petrosia truncata*, strongyla; × 122, ... 13

Fig. 15. *Halichondria caduca*, oxea; × 122, ... 3

Fig. 16. *Petrosia hispida*, oxea; × 122, ... 14


4 x 122.
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15 x 122.

PLATE III.

PLATE III.

PAGE

Fig. 1. *Petrosia truncata;* natural size, ... 12

Fig. 2. *Petrosia hispida;* natural size, ... 14

Fig. 3. *Petrosia similis,* repent form; natural size, ... 9

Fig. 4. *Petrosia similis,* erect, lobose form; natural size, ... 9

Fig. 5. *Petrosia similis,* var. *compacta;* natural size, ... 12

Fig. 6. *Petrosia similis,* var. *massa;* natural size, ... 11

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PETROSIA.

PLATE IV.

PLATE IV.

PAGE

Fig. 1. *Pachychalina melior;* natural size, ... 20

Fig. 2. *Pachychalina fragilis;* natural size, ... 20

Fig. 2*a*. *Pachychalina fragilis;* natural size.

Fig. 3. *Pachychalina fibrosa* (Bahia (? or Bermuda)); natural size, . . 21

Fig. 4. *Pachychalina fibrosa*, var. (Station 208); natural size, . . . 22

1.

4.

2

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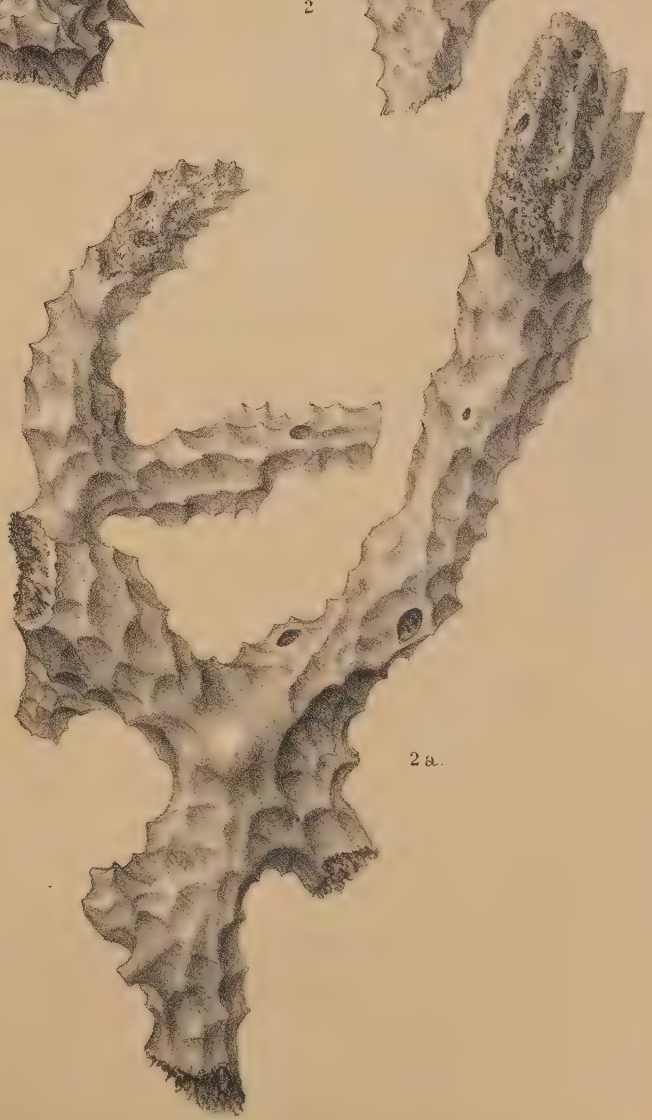

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PACHYCHALINA.

PLATE V.

PLATE V.

PAGE

Fig. 1. *Pachychalina lobata;* natural size, ... 22

Fig. 2. *Chalina pergamentacea; a,* flat side; *b,* edge, showing oscula; natural size, ... 27

Fig. 3. *Chalina rectangularis;* natural size, ... 27

Fig. 4. *Chalina palmata;* natural size, ... 26

Fig. 5. *Pachychalina* (?) *pedunculata;* natural size, ... 25

Fig. 6. *Pachychalina megalorrhaphis;* natural size, ... 23

A. Gawan del et lith.

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PACHYCHALINA, CHALINA.

PLATE VI.

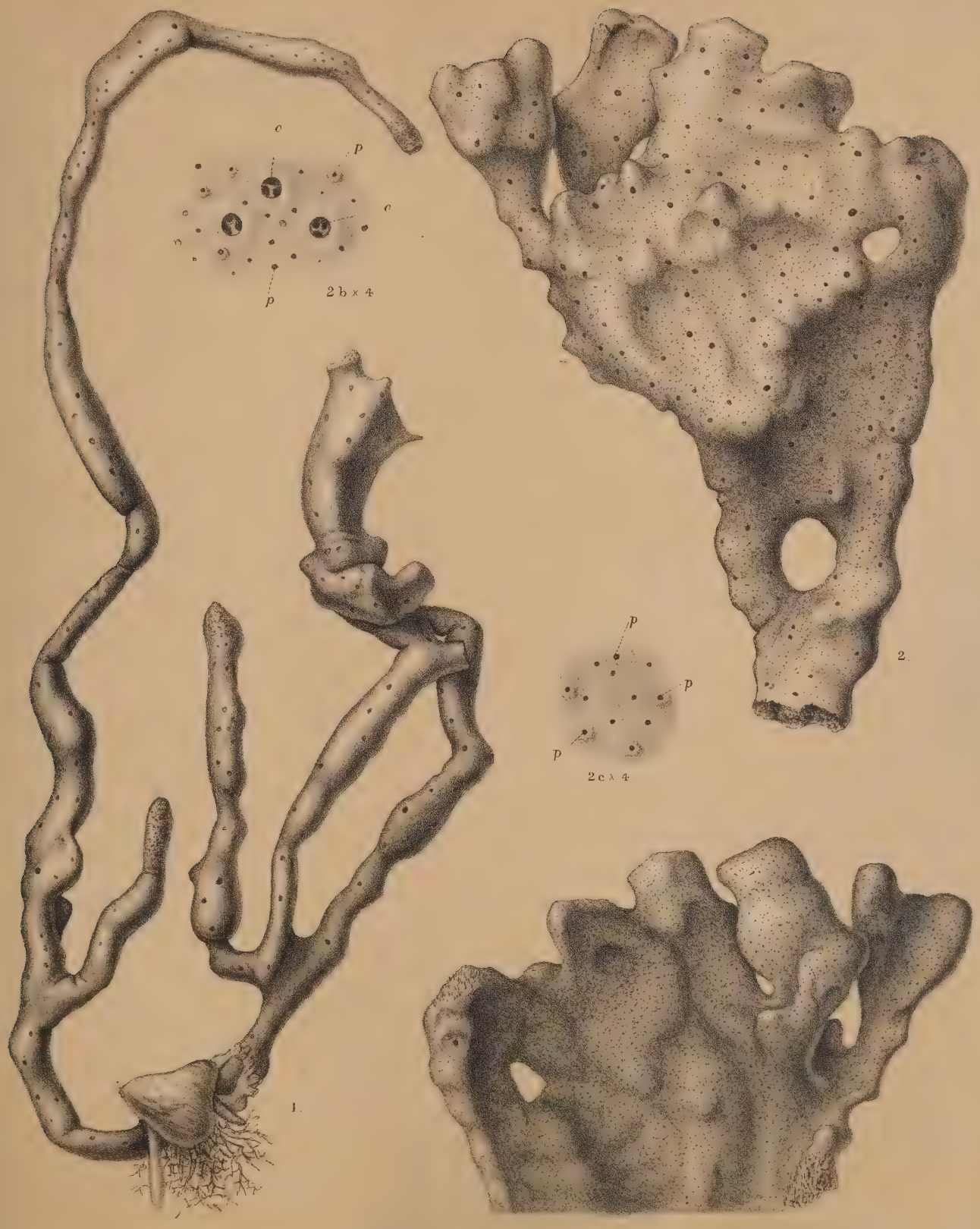
PLATE VI.

PAGE

Fig. 1. *Pachychalina elongata*; natural size, ... 23

Fig. 2. *Pachychalina* (?) *punctata*, osculum-bearing surface; natural size, . 24

Fig. 2*a*. Upper portion of surface without oscula; natural size.
Fig. 2*b*. Portion of osculum-bearing surface; *o*, oscula; *p*, pores (?); × 4.
Fig. 2*c*. Portion of surface without oscula; *p*, pores (?); × 4.



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PACHYCHALINA.

PLATE VII.

PLATE VII.

PAGE

Fig. 1. *Siphonochalina intermedia;* natural size, ... 30

Fig. 2. *Siphonochalina annulata;* natural size, ... 31

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SIPHONOCHALINA.

PLATE VIII.

PLATE VIII.

PAGE

Fig. 1. *Rhizochalina pedunculata;* natural size, ... 35

Fig. 2. *Rhizochalina fistulosa* (Station 188); natural size, . . . 32

Fig. 2*a*. Section; × 2.

Fig. 3. *Gellius carduus* (Prince Edward Island); natural size, . . . 39

Fig. 4. *Gellius varius;* natural size, ... 38

Fig. 5. *Rhizochalina putridosa* (Station 162); × $\frac{5}{8}$, ... 33

Fig. 5*a*. Fistula of same; × 2.

Fig. 6. *Gellius calyx;* natural size, ... 43

Fig. 6*a*. Osculum of same; natural size.

Fig. 7. *Gellius glacialis;* natural size, ... 41

Fig. 8. *Gellius glacialis*, var. *nivea;* natural size, ... 42

Fig. 9. *Sideroderma navicelligerum; a*, parasitic Alcyonarians; natural size, . 115

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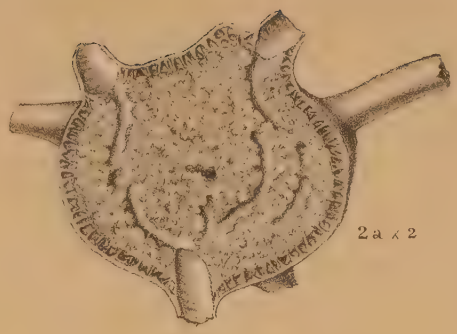

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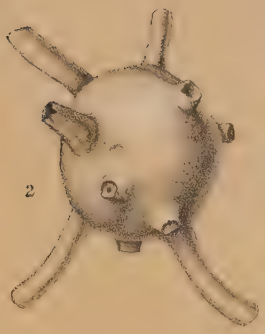

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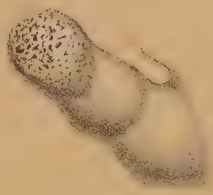

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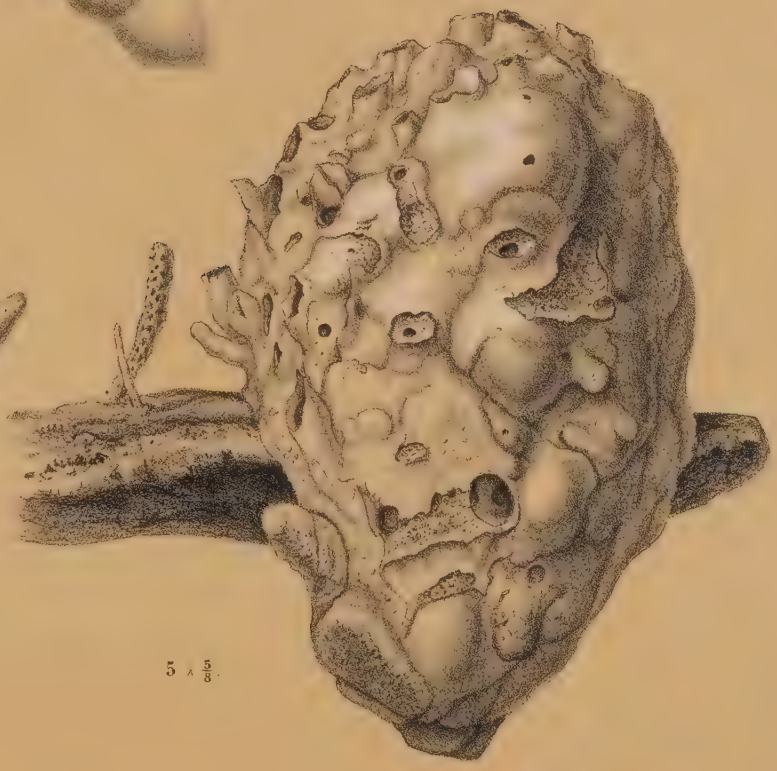

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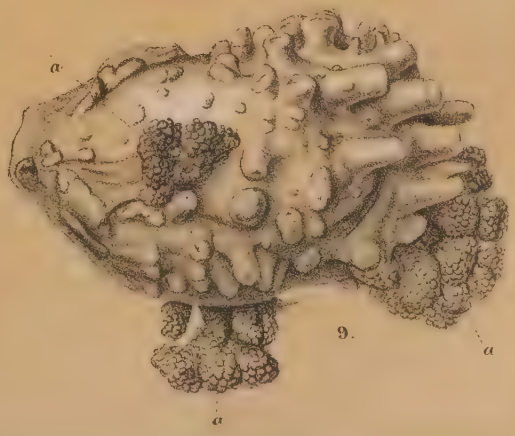

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PLATE IX.

PLATE IX.

PAGE

Fig. 1. *Rhizochalina putridosa*, oxea from the interior of the sponge; × 325, . 34

Fig. 2. *Rhizochalina pedunculata*, strongyla from the dermal layer; *a*, *d*, adult; *b*, *c*, probably young forms, showing central inflation; × 325, . 35

Fig. 3. *Oceanapia robusta*; *a*, *b*, *c*, oxea; *d*, sigmata; × 325, . . . 37

Fig. 4. *Rhizochalina fistulosa*, oxea; *a*, *b*, adult; *c*, young; × 325, . . 32

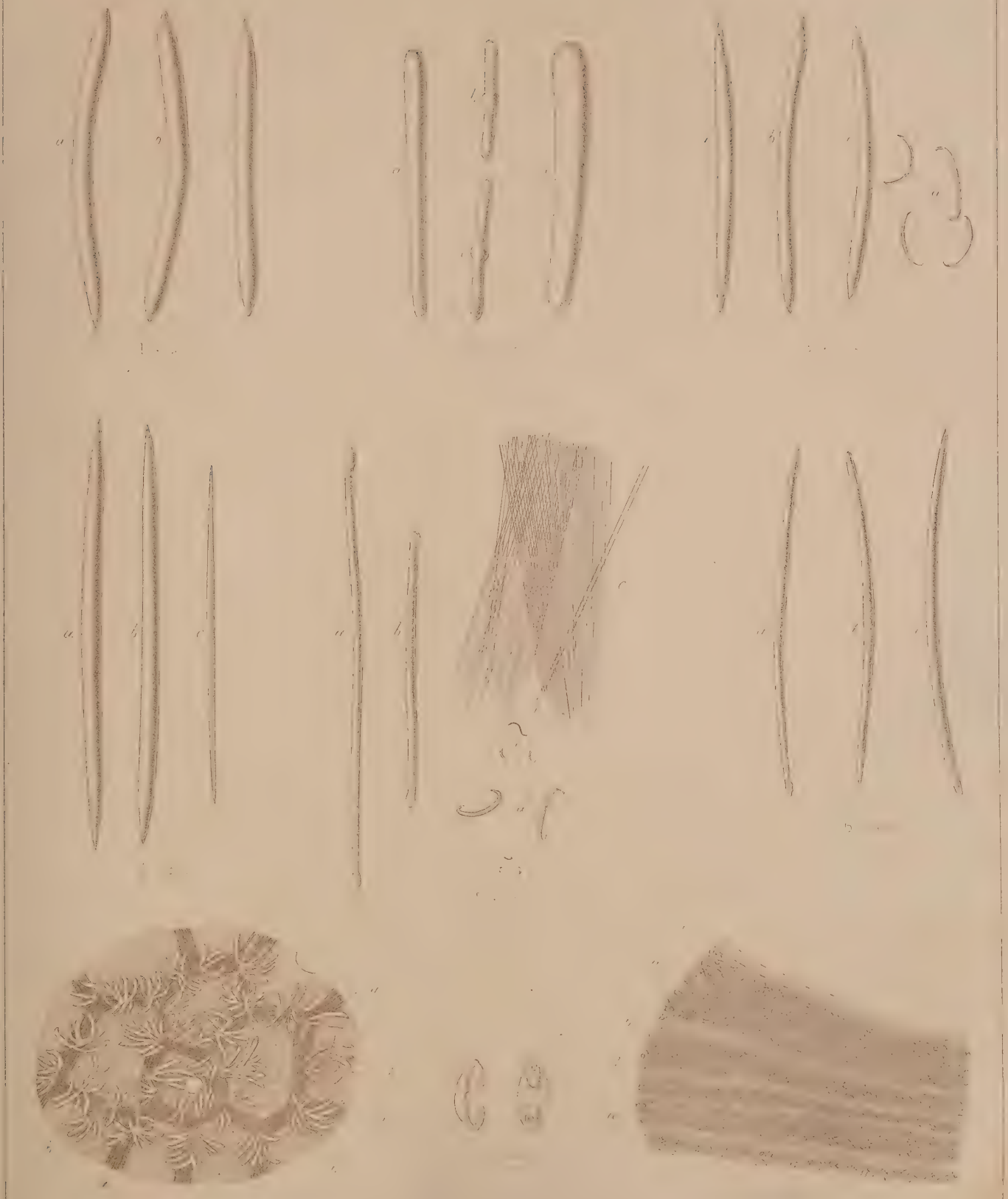
Fig. 5. *Sideroderma navicelligerum*; *a*, *b*, tylota; *c*, trichodragma; *d*, larger sigmata; *e*, smaller sigmata; *f*, minute isochelæ; × 175, . 115

Fig. 6. *Rhizochalina pedunculata*, oxea from the interior of the sponge; × 325, 36

Fig. 7. *Rhizochalina putridosa*, portion of the end of a fistula, showing the arrangement of the spicules; *a*, fibres of the "bast" layer; *b*, tufts of spicules echinating them, ... 34

Fig. 8. *Sideroderma navicelligerum*, minute isochelæ, side and front views; × 1400, ... 116

Fig. 9. *Sideroderma navicelligerum*, portion of vertical section of rind, showing the alternating layers of spicules; *a*, cut ends of spicules; *b*, longitudinally placed spicules; *c*, outermost layer without spicules, . 115



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RHIZOCHALINA, OCEANAPIA, SIDERODERMA.

PLATE X.

PLATE X.

PAGE

Gelliodes poculum; natural size, ... 48

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GELLIODES [illegible]CULUM

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PLATE XI.

PLATE XI.

PAGE

Fig. 1. *Tedania infundibuliformis;* natural size, ... 54

Fig. 2. *Tedania actiniiformis; o*, oscula; *p. z*, pore-zone; × 2, . . . 55

Fig. 2*a*. Portion of pore-zone, showing the pores; × 10.

Fig. 3. *Tedania digitata*, cylindrical specimen (restored); natural size, . . 51

Fig. 4. *Tedania massa* (Station 320); *o*, oscula; natural size, ... 53

Fig. 4*a*. Portion of surface, showing groups of pores; × 5.

Fig. 5. *Tedania tenuicapitata* (Station 314); natural size, . . . 52

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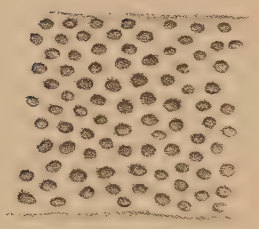
4a x 5



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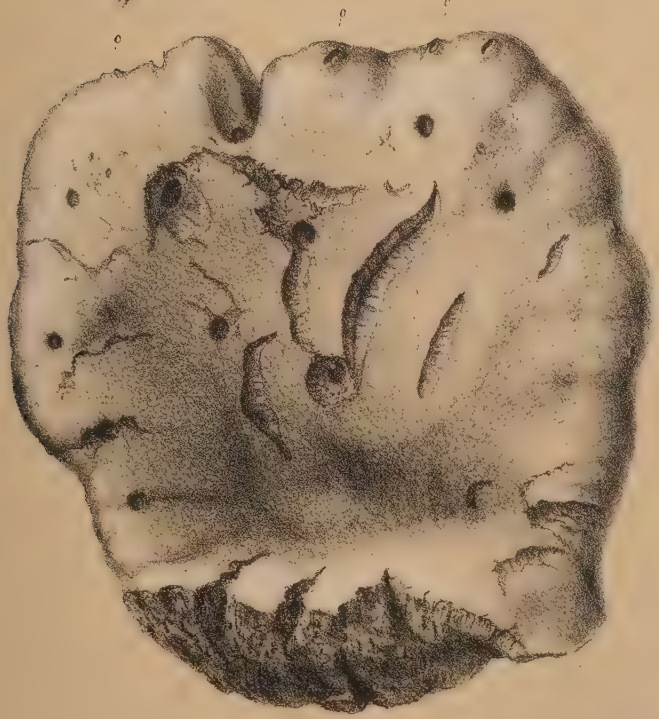

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TEDANIA

PLATE XII.

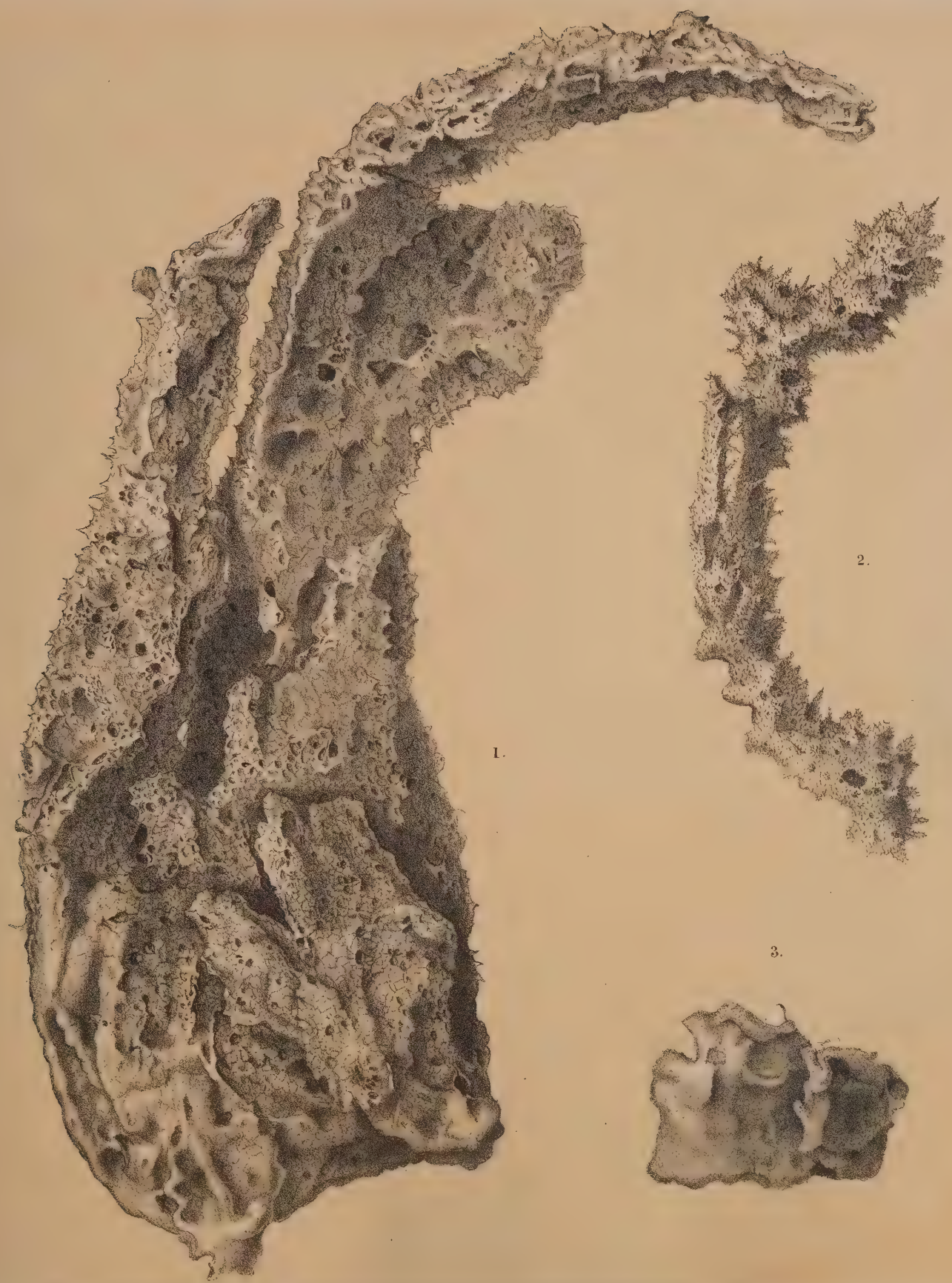
PLATE XII.

PAGE

Fig. 1. *Vomerula esperioides*; natural size, ... 60

Fig. 2. *Gelliodes fibulata*; natural size, ... 47

Fig. 3. *Gelliodes licheniformis*; natural size, ... 48



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GELLIODES, VOMERULA.

PLATE XIII.

PLATE XIII.

PAGE

Fig. 1. *Gellius glacialis*, oxeote spicule from dermal layer; × 180, . . 41

Fig. 2. *Gellius calyx*, oxeote spicule from dermal layer; × 180, . . 44

Fig. 3. *Gellius* sp., strongylote spicule; × 180, ... 46

Fig. 4. *Gellius glacialis*, var. *nivea*, oxeote spicule; × 180 . . . 42

Fig. 5. *Gellius flagellifer*, oxeote spicule; × 180, ... 43

Fig. 6. *Gellius carduus*, var. *magellanica*, oxeote spicule; × 180, . . 40

Fig. 7. *Gellius carduus*, strongylote spicule; × 180, ... 39

Fig. 8. *Gellius lævis*, strongylote spicule; × 180, ... 40

Fig. 9. *Gellius calyx*, sigmata; × 320, ... 44

Fig. 10. *Gellius flagellifer*, sigma; × 320, ... 43

Fig. 11. *Esperella murrayi*, sigmata; × 330, ... 69

Fig. 12. *Gellius glacialis*, var. *nivea*, sigmata; × 320, ... 42

Fig. 13. *Esperella murrayi*, diagrammatic vertical section across one of the crack-like pore-areas, showing the arrangement of the skeleton; *a*, pore-area; *b*, dermal skeleton; *c*, primary fibres; *d*, secondary fibres, . 68

Fig. 14. *Esperella murrayi*, trichodragmata; × 260, ... 69

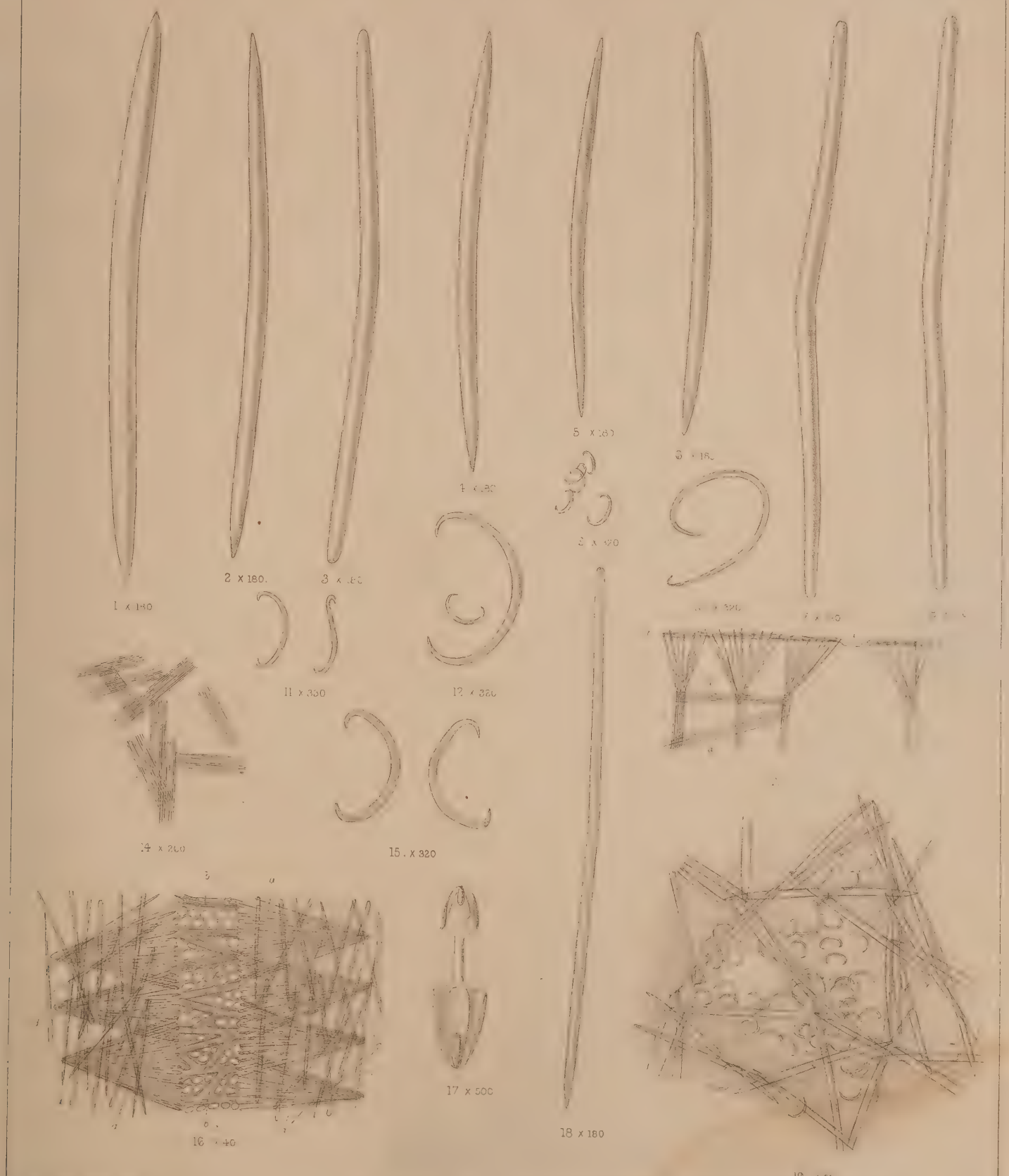
Fig. 15. *Gellius glacialis*, sigmata; × 320, ... 41

Fig. 16. *Esperella murrayi*, portion of a pore-area, seen from above, showing the arrangement of the surrounding skeleton, slightly diagrammatic; *a*, brushes of spicules fringing the margins of the crack; *b*, transverse bands of fibres; *c*, pores; *d*, spicules of the dermal skeleton. (The microsclera are not represented.) × 40, ... 68

Fig. 17. *Esperella murrayi*, palmate anisochela from a rosette; × 500, . 69

Fig. 18. *Esperella murrayi*, stylus; × 180, ... 69

Fig. 19. *Gellius glacialis*, portion of dermal layer, showing the arrangement of the spicules; × 62, ... 41



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GELLIUS, ESPERELLA.

PLATE XIV.

PLATE XIV.

PAGE

Fig. 1. *Esperella murrayi*; *o*, oscula; *p.a*, pore-areas; natural size, . . 67

Fig. 1*a*. Summit of one of the lobes, showing the oscula; natural size.

Fig. 2. *Esperella biserialis*, a specimen with most of the soft tissues still attached to the axis; *a*, spicular axis, seen where the soft tissues have been removed; × 2, ... 75

Fig. 3. *Esperella biserialis*, a specimen from which the soft tissues have been removed; *e*, embryos within the spicular axis; × 2, . . . 75

Fig. 4. *Esperella fusca*; natural size, ... 72

Fig. 5. *Esperella mammiformis*, an unattached specimen, with "pinched-up" base; *o*, osculum; × $\frac{3}{2}$, ... 64

Fig. 6. *Esperella mammiformis*, a specimen attached to a stone; *o*, osculum; × $\frac{3}{2}$, ... 63

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ESPERELLA.

PLATE XV.

PLATE XV.

PAGE

Fig. 1. *Esperella mammiformis*, subtylostylus; × 180, ... 63

Fig. 2. *Esperella lapidiformis*, stylus; × 75, ... 65

Figs. 3, 3*a*. *Esperella fusca*, tylostyli; × 180, ... 72

Figs. 4, 4*a*. *Esperella arenicola*, tylostyli; × 175, ... 73

Fig. 5. *Esperella nuda*, tylostylus; × 175, ... 71

Fig. 6. *Esperella porosa*, tylostylus; × 180, ... 70

Figs. 7, 7*a*. *Esperella simonis*, subtylostyli; × 180, ... 74

Fig. 8. *Esperella biserialis*, small tylostylus; × 180, ... 75

Figs. 8*a*, 8*b*. Large styli from the stem; × 78.

Fig. 9. *Esperella porosa*, sigmata; × 180, ... 70

Fig. 10. *Esperella lapidiformis*, palmate anisochela, front view; × 360, . 65

Fig. 10*a*. Palmate anisochela, side view; × 360.

Fig. 11. *Esperella nuda*, palmate anisochelæ, front and side views; × 860, . 71

Figs. 12, 12*a*. *Esperella simonis*, toxa; × 180, ... 74

Fig. 12*a*. Shows the remains of the cell in which the spicule developed still adhering to it.

Fig. 13. *Esperella simonis*, sigma; × 180, ... 74

Fig. 14. *Esperella nuda*, sigmata; × 180, ... 71

Fig. 15. *Esperella fusca*, palmate anisochela, three-quarters front view; × 360, 72

Fig. 15*a*. Palmate anisochela, side view; × 360.

Fig. 16. *Esperella simonis*, palmate anisochela, front view; × 360, . . . 74

Fig. 16*a*. Palmate anisochela, side view; × 360.

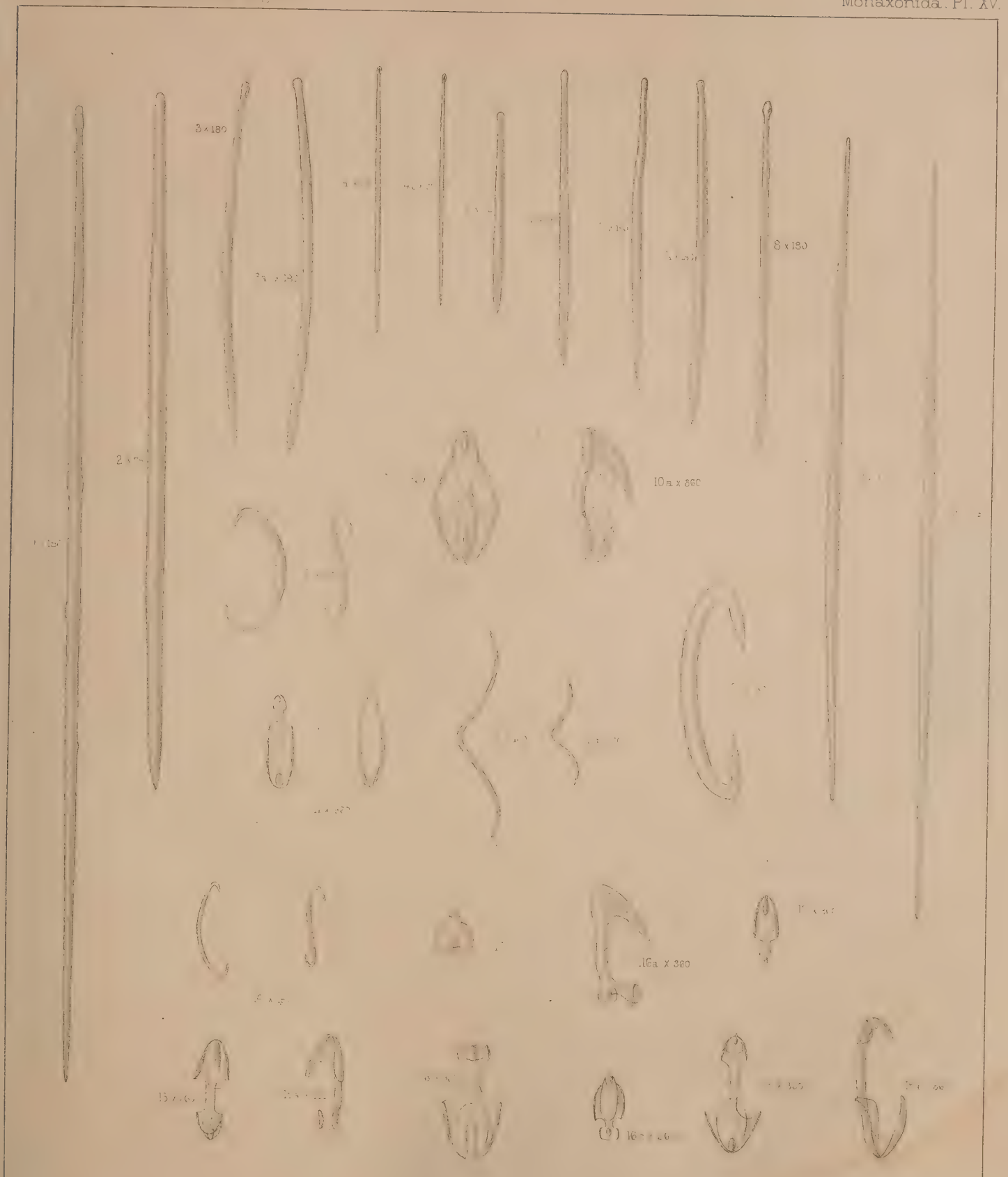
Fig. 16*b*. Palmate anisochela, small end, seen from in front, looking from the larger end.

Fig. 16*c*. Young anisochela, front view; × 360.

Fig. 17. *Esperella porosa*, palmate anisochela, front view; × 360, . . 70

Fig. 18. *Esperella mammiformis*, palmate anisochela, front view; × 360, . 63

Fig. 18*a*. Palmate anisochela, side view; × 360.



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ESPERELLA

PLATE XVI.

PLATE XVI.

PAGE

Fig. 1. *Esperella nuda*, portion of specimen ; natural size, . . . 70

Fig. 2. *Esperella lapidiformis;* × $\frac{2}{3}$, ... 64

Fig. 2*a*. Vertical section of same, showing the position of the embryos (*e*) ; × 2.
Fig. 2*b*. Portion from top of same, showing oscula (*o*); natural size.

Fig. 3. *Iophon chelifer* (Station 145); natural size, ... 119

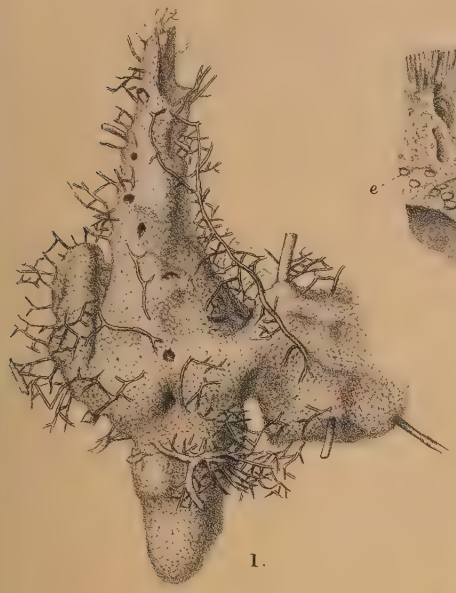
Fig. 4. *Iophon cylindricus;* natural size, ... 120

Fig. 5. *Esperella porosa;* the soft parts have been removed from the lower half of the sponge, showing the fibre ; *o*, oscula ; natural size, . . 69

Fig. 6. *Iophon laminalis*, portion of specimen ; natural size, . . . 121

Fig. 7. *Esperella gelatinosa ; o*, osculum ; natural size, ... 66

Fig. 8. *Esperella arenicola*, portion of upper surface ; *o*, oscula ; natural size, . 72



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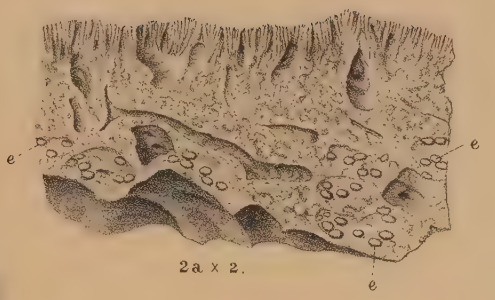

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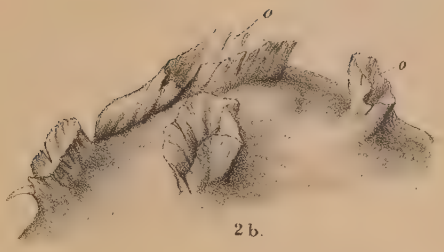

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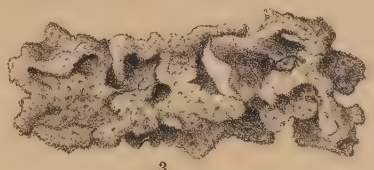

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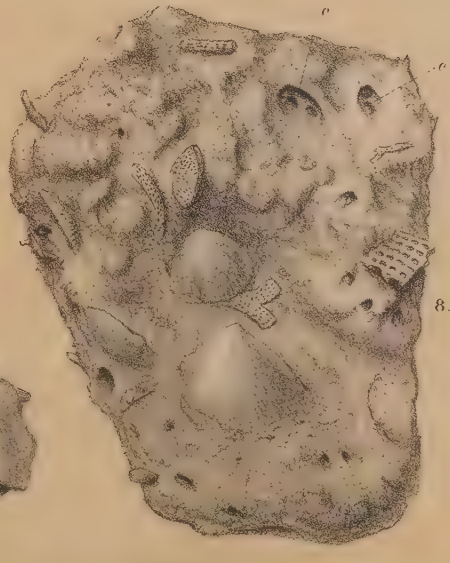

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ESPERELLA, IOPHON.

PLATE XVII.

PLATE XVII.

PAGE

Fig. 1. *Iophon chelifer*; *a*, *b*, spined styli; *c*, tylote spicule; × 180, . . 119

Fig. 2. *Vomerula esperioides*; *a*, *b*, two views of the diancistron, × 180; *c*, sigma, × 475; *d*, young diancistron, showing the hooks still united to the shaft by a thin web, × 475, ... 61

Fig. 3. *Iophon chelifer*; *a*, *b*, *c*, *d*, different views of the bipocilli; × 900, . 119

Fig. 4. *Vomerula esperioides*, stylus; × 180, ... 61

Fig. 5. *Iophon abnormalis*; *a*, *b*, tylota; *c*, stylus; × 180, . . . 122

Fig. 6. *Iophon cylindricus*; *a*, *b*, styli; *c*, tylote spicule; × 180, . . 120

Fig. 7. *Iophon abnormalis*, rosette of anisochelæ; × 540, . . . 122

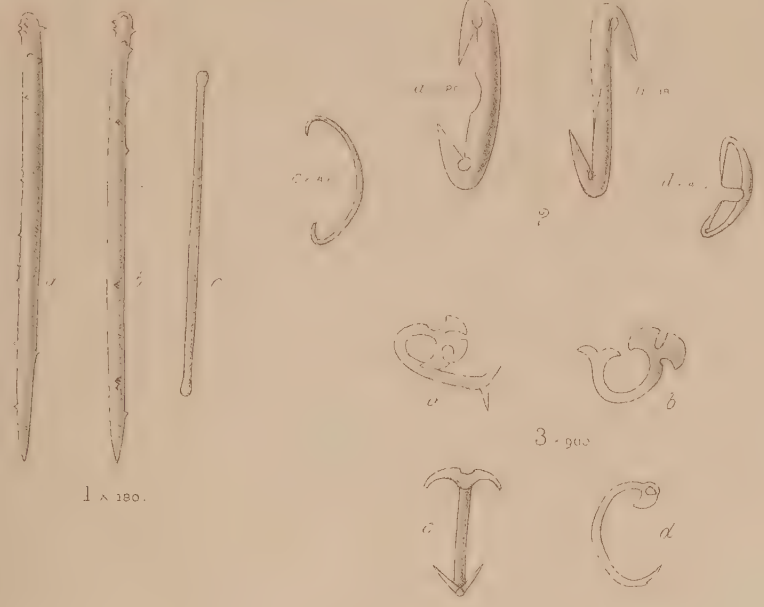
Fig. 8. *Iophon chelifer*, anisochela, side view; × 1200, . . . 119

Fig. 9. *Iophon laminalis*; *a*, *b*, *c*, three views of the bipocilli; × 1350, . 121

Fig. 10. *Iophon* (*?*) *omnivorus*, portion of dermal layer, showing dermal skeleton of foreign bodies, and pores; × 175, ... 122

Fig. 11. *Iophon laminalis*; *a*, tylote spicule; *b*, stylus; × 180, . . . 121

Fig. 12. *Vomerula esperioides*, portion of dermal layer, showing pores and dermal skeleton; × 63, ... 60



1 × 180.

3 × 900

5 × 80

7 × 540

8 × 450

9 ×

11 × 180

10 × 175

IOPHON, VOMERULA.

PLATE XVIII.

PLATE XVIII.

PAGE

Fig. 1. *Esperiopsis challengeri*, half front view of an adult specimen; natural size, ... 80

Fig. 2. *Esperiopsis challengeri*, half back view of an adult specimen; natural size, 80

Fig. 3. *Esperiopsis challengeri*, side view of a young specimen with only two lobes; *a*, the commencing bud of a third lobe; natural size, . . 81

Fig. 4. *Esperiopsis challengeri*, a portion of the concave surface of one of the lobes, showing the pores and dermal skeleton; × 50, . . . 81

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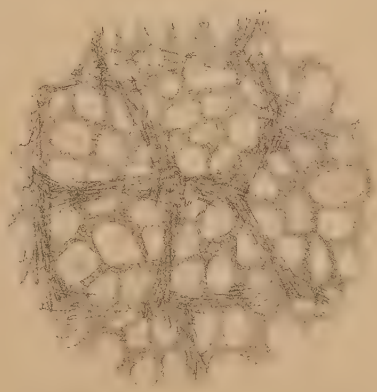

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ESPERIOPSIS CHALLENGERI.

PLATE XIX.

PLATE XIX.

PAGE

Fig. 1. *Esperiopsis profunda*, subtylostylus; × 190, ... 83

Fig. 1*a*. Palmate isochela, side view; × 284.
Fig. 1*b*. Palmate isochela, front view; × 284.

Fig. 2. *Esperiopsis cylindrica*, stout stylus projecting from the surface amongst a number of slender styli; × 190, ... 80

Fig. 2*a*. Slender stylus from one of the surface brushes; × 190
Fig. 2*b*. Isochela, side view; × 500.

Fig. 3. *Amphilectus apollinis*, large stylus; × 284, ... 124

Fig. 3*a*. Small stylus with minutely spined base; × 284.
Fig. 3*b*. Toxite; × 284.
Fig. 3*c*. Isochela; × 284.

Fig. 4. *Amphilectus annectens*, stylus of the main skeleton; × 122, . . 128

Fig. 4*a*. Tylote spicule from the dermal layer; × 190.

Figs. 5, 5′. *Amphilectus pilosus*, styli; × 66, ... 127

Figs. 5*a*, 5*a*′, 5*a*″, 5*a*‴, 5*a*⁗, 5*a*⁗′. A series of spicules showing the transition from small toxa (5*a*) to long, slender oxea (5*a*⁗′); × 122.
Fig. 5*b*. Toxite with the remains of the mother-cell still adherent; × 190.

Figs. 6, 6′. *Esperiopsis symmetrica*; styli; × 122, ... 78

Fig. 6*a*. Portion of the membrane from between two radiating spicular processes, loaded with different kinds of microsclera; × 512.
Fig. 6*b*. Palmate isochela, front view; × 512.
Fig. 6*c*. Palmate isochela, side view; × 512.

Figs. 7, 7′. *Esperiopsis edwardii*, var. *americana*, styli; × 284, . . 79

Fig. 7*a*. Isochela, side view; × 284.

Fig. 8. *Esperiopsis challengeri*, stylus; × 284, ... 82

Fig. 8*a*. Isochela, side view; × 284.
Fig. 8*b*. Isochela, front view; × 284

Figs. 9, 9′. *Esperiopsis pulchella*, polytylote megasclera; × 284, . . 85

Fig. 9*a*. Palmate isochela, front view; × 284.
Fig. 9*b*. Palmate isochela, side view; × 284.
Fig. 9*c*. Young isochela; × 284.
Fig. 9*d*. Still younger isochela; × 284

Fig. 10. *Amphilectus ceratosus*, tylote spicule; × 500, ... 125

Fig. 10*a*. Isochela, side view; × 500.

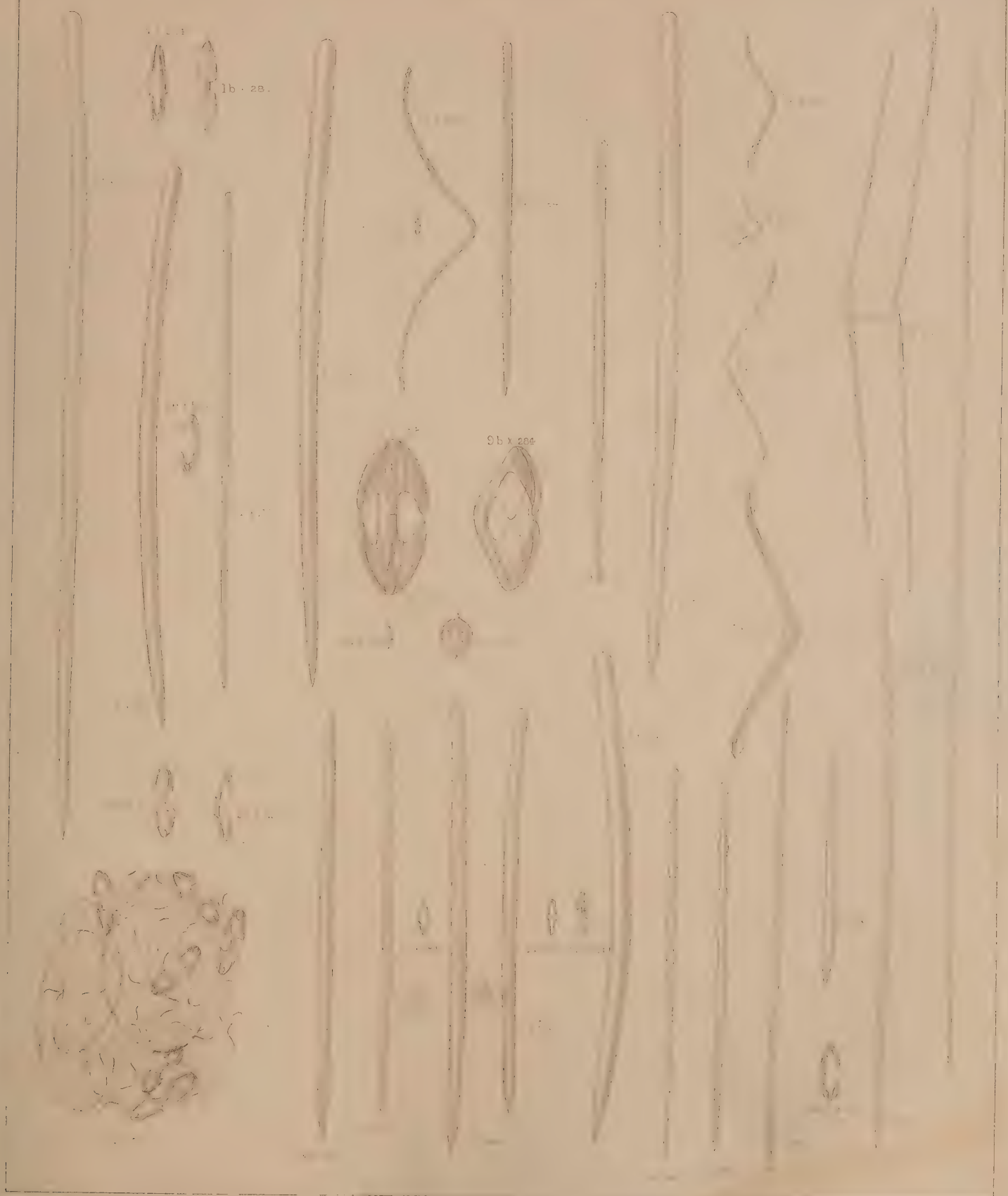

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PLATE XX.

PLATE XX.

PAGE

Figs. 1, 1*a*. *Chondrocladia clavata*, two specimens; × 4. . . . 100

Fig. 2. *Cladorhiza longipinna*, × 2, ... 92

Fig. 3. *Cladorhiza moruliformis*, × 2, ... 90

Fig. 4. *Chondrocladia crinita*; natural size, ... 101

Fig. 5. *Axoniderma mirabile*, × 2, ... 97

Fig. 6. *Cladorhiza abyssicola*, var. *linearis*, two specimens united to one another by interlocking of the spicular tufts; the soft parts have been washed off; × 2, ... 90

Fig. 7. *Cladorhiza similis*; × 2, ... 93

Fig. 8. *Cladorhiza inversa*; × 2, ... 94

Fig. 9. *Cladorhiza* (?) *tridentata*, seen from above; × 2, . . . 95

Fig. 9*a*. Side view; × 2.

Fig. 10. *Cladorhiza abyssicola*, var. *rectangularis*; × 2. . . . 88

Fig. 11. *Meliiderma stipitata*, natural size, ... 102

Fig. 12. *Chondrocladia concrescens* (?), fragment; natural size, . . . 99

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CLADORRHIZA, AXONIDERMA, CHONDROCLADIA, MELLIDERMA.

PLATE XXI.

PLATE XXI.

PAGE

Fig. 1. *Cladorhiza moruliformis*, stylus; × 44, ... 91

Fig. 2. *Cladorhiza abyssicola*, var. *linearis*, small stylus; × 190, . . 90

Fig. 2*a*. Large stylus; × 44.

Fig. 3. *Chondrocladia crinita*, stylus, from one of the supporting processes; × 44, ... 101

Fig. 4. *Cladorhiza longipinna*, small tylostylus; × 190, . . . 92

Figs. 5, 5*a*, 5*b*. *Cladorhiza similis*, small tylostyli; × 180, . . . 93

Figs. 6, 6*a*, 6*b*, 6*c*. *Meliiderma stipitata*, tylostyli from the stem; × 44, . 102

Fig. 7. *Chondrocladia concrescens* (*?*); stylus from axis; × 44, . . 100

Fig. 7*a*. Base and apex of another stylus from axis; × 190.

Fig. 8. *Axoniderma mirabile*, anisochelæ; *a*, front view; *b*, side view; × 430, 98

Fig. 9. *Axoniderma mirabile*; *a*, *b*, amphiastra, seen from the side; *c*, *d*, end views of same; × 290, ... 98

Fig. 10. *Axoniderma mirabile*, sigmata; × 290, ... 98

Fig. 11. *Chondrocladia clavata*, isochelæ; *a*, front view; *b*, side view; × 290, ... 100

Fig. 12. *Chondrocladia concrescens* (*?*), isochelæ; *a*, side view; *b*, *c*, end views; *d*, front view; × 290, ... 100

Fig. 13. *Cladorhiza inversa*, anisochelæ, showing the nucleus of the mother-cell (*n*), the cell itself has shrunk up on the spicule; *a*, front view; *b*, side view; × 900, ... 94

Fig. 14. *Meliiderma stipitata*, isochelæ; *a*, side view; *b*, *c*, end views; *d*, back view; × 290, ... 103

Fig. 15. *Cladorhiza moruliformis*, sigma; × 190, ... 91

Fig. 16. *Cladorhiza* (*?*) *tridentata*, sigmata; × 190, ... 95

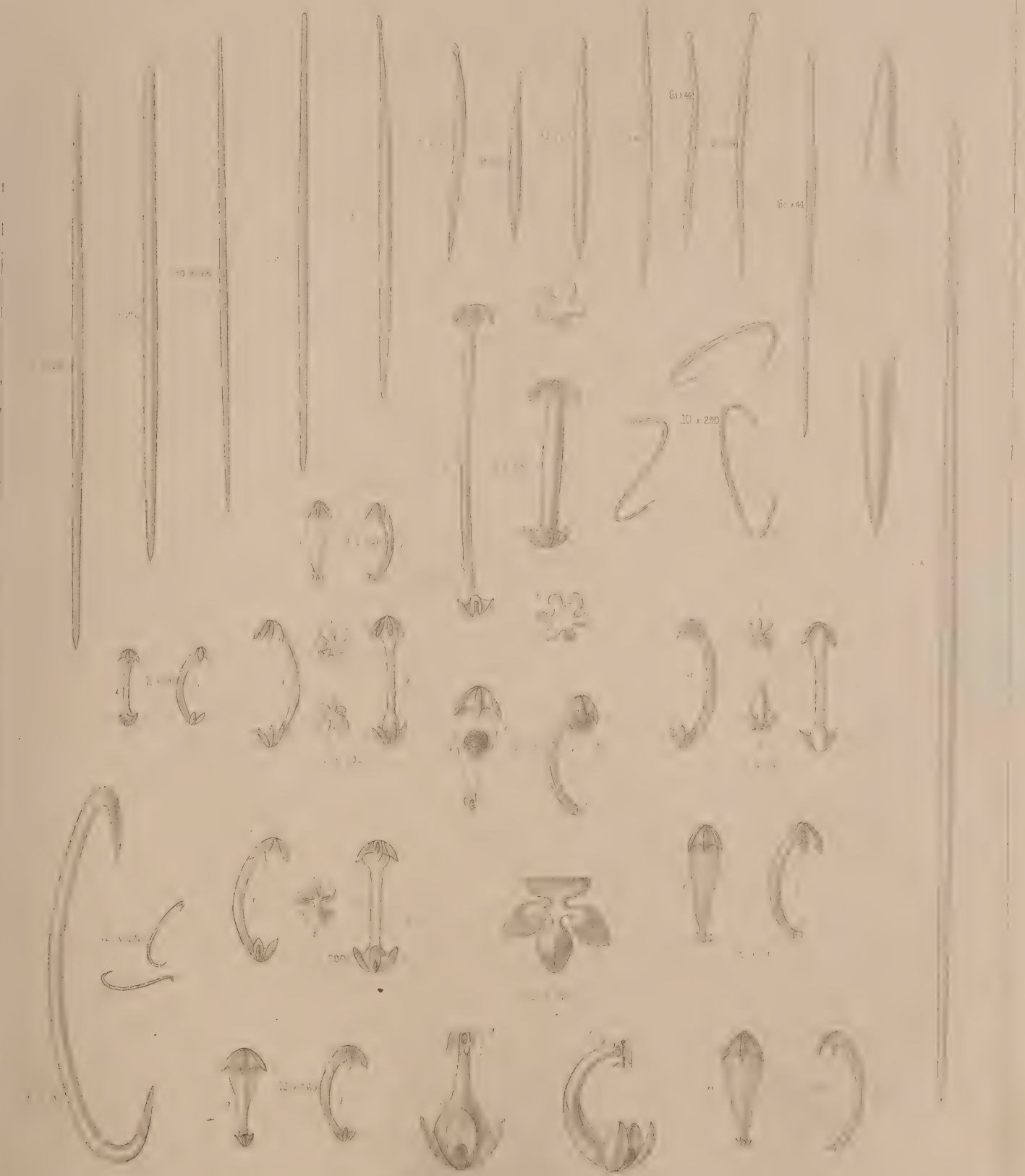
Fig. 17. *Chondrocladia crinita*, isochelæ; *a*, side view; *b*, end view; *c*, front view; × 290, ... 101

Fig. 18. *Cladorhiza similis*, anisochelæ; *a*, front view; *b*, side view; × 900, . 93

Fig. 19. *Cladorhiza moruliformis*, anisochelæ; *a*, front view; *b*, side view; × 360, ... 91

Fig. 20. *Cladorhiza* (*?*) *tridentata*, anisochelæ; *a*, front view; *b*, side view; *c*, end view of larger end; × 360, ... 95

Fig. 21. *Cladorhiza longipinna*, smaller anisochelæ; *a*, front view; *b*, side view; × 675, ... 92



CLADORRHIZA, AXONIDERMA, CHONDROCLADIA, MELIIDERMA.

PLATE XXII.

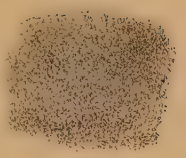
PLATE XXII.

PAGE

Fig. 1. *Desmacidon* (*Homœodictya*) *grandis*; × $\frac{5}{6}$, ... 111

Fig. 1*a*. Portion of the surface without oscula; × 3.

Fig. 1*b*. Portion of the osculum-bearing surface, showing the stellately arranged oscula (*o*); × 3.



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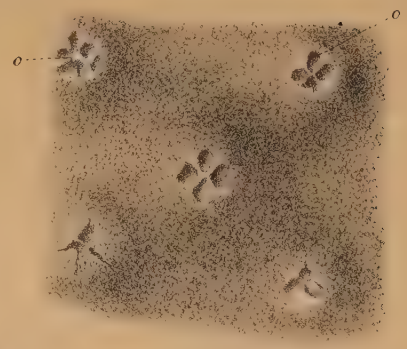

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1 × $\frac{5}{6}$.

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HOMOEODICTYA GRANDIS.

PLATE XXIII.

PLATE XXIII.

PAGE

Fig. 1. *Thrinacophora funiformis*, large, unequal ended, oxeote spicule, × 122, 195

Figs. 1*a*, 1*b*. Styli; × 122.
Figs. 1*c*, 1*d*. Smaller oxea; × 190.
Figs. 1*e*, 1*f*. Cladostrongyla; × 190.
Fig. 1*g*. Trichodragmata; × 190.

Fig. 2. *Tedania massa*, stylus; × 190, ... 54

Figs. 2*a*, 2*b*. Tornota; × 190.

Figs. 3, 3*a*. *Desmacidon* (*Homœodictya*) *kerguelenensis*, oxea; × 190, . . 110

Fig. 3*b*. Isochela, side view; × 512.
Fig. 3*c*. Isochela, front view; × 512.

Figs. 4, 4*a*. *Desmacidon* (?) *ramosa*, oxea; × 190, ... 107

Fig. 4*b*. Isochela, side view; × 512.
Fig. 4*c*. Isochela, front view; × 512

Figs. 5, 5*a*. *Desmacidon conulosa*, oxea; × 190, ... 106

Fig. 5*b*. Isochela, side view; × 512.
Fig. 5*c*. Isochela, front view; × 512.

Figs. 6, 6*a*, 6*b*. *Trachytedania patagonica*, spined styli; × 190, . . 57

Fig. 6*c*. Oxeote spicule; × 190.

Figs. 7, 7*a*. *Desmacidon reptans*, oxea; × 190, ... 105

Fig. 7*b*. Isochela, side view; × 512.
Figs. 7*c*, 7*d*. Sigmata; × 512.

Figs. 8, 8*a*. *Phelloderma radiatum*, styli (polytylote); × 190, . . . 114

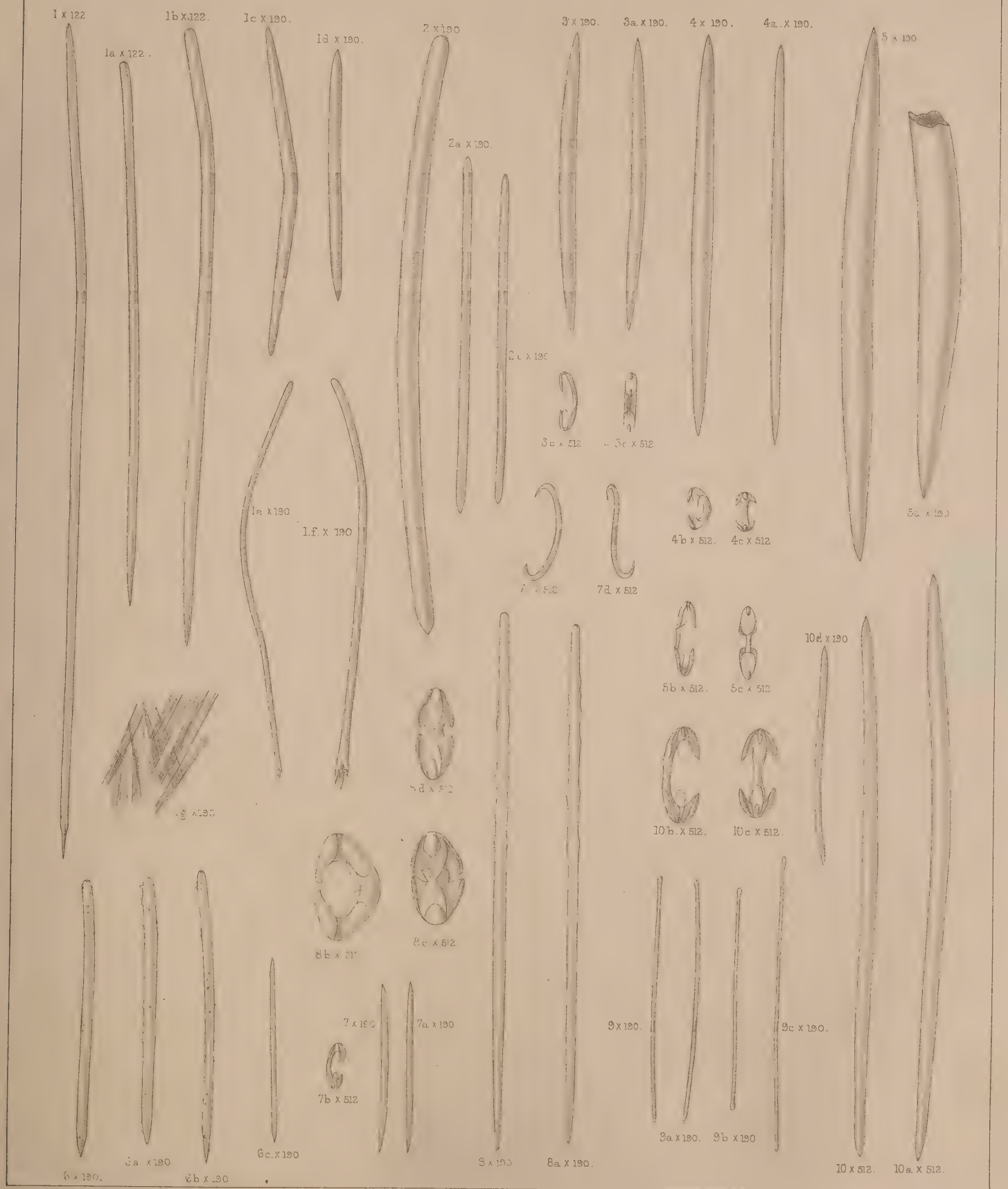
Fig. 8*b*. Isochela, side view; × 512.
Fig. 8*c*. Isochela, front view, the two front teeth united; × 512.
Fig. 8*d*. Isochela, front view, the two front teeth separate; × 512.

Figs. 9, 9*a*. *Tedania commixta*, subtylostyli; × 190, . . . 53

Figs. 9*b*, 9*c*. Tylota; × 190.

Figs. 10, 10*a*. *Desmacidon fruticosa*, var., oxea; × 512, . . . 104

Fig. 10*b*. Isochela, side view; × 512.
Fig. 10*c*. Isochela, front view; × 512.
Fig. 10*d*. Oxeote spicule; × 190.



Arthur Dendy del. R. Morgan lith.

Mintern Bros. imp.

TEDANIA, TRACHYTEDANIA, DESMACIDON, HOMOEODICTYA, PHELLODERMA, THRINACOPHORA.

PLATE XXIV.

PLATE XXIV.

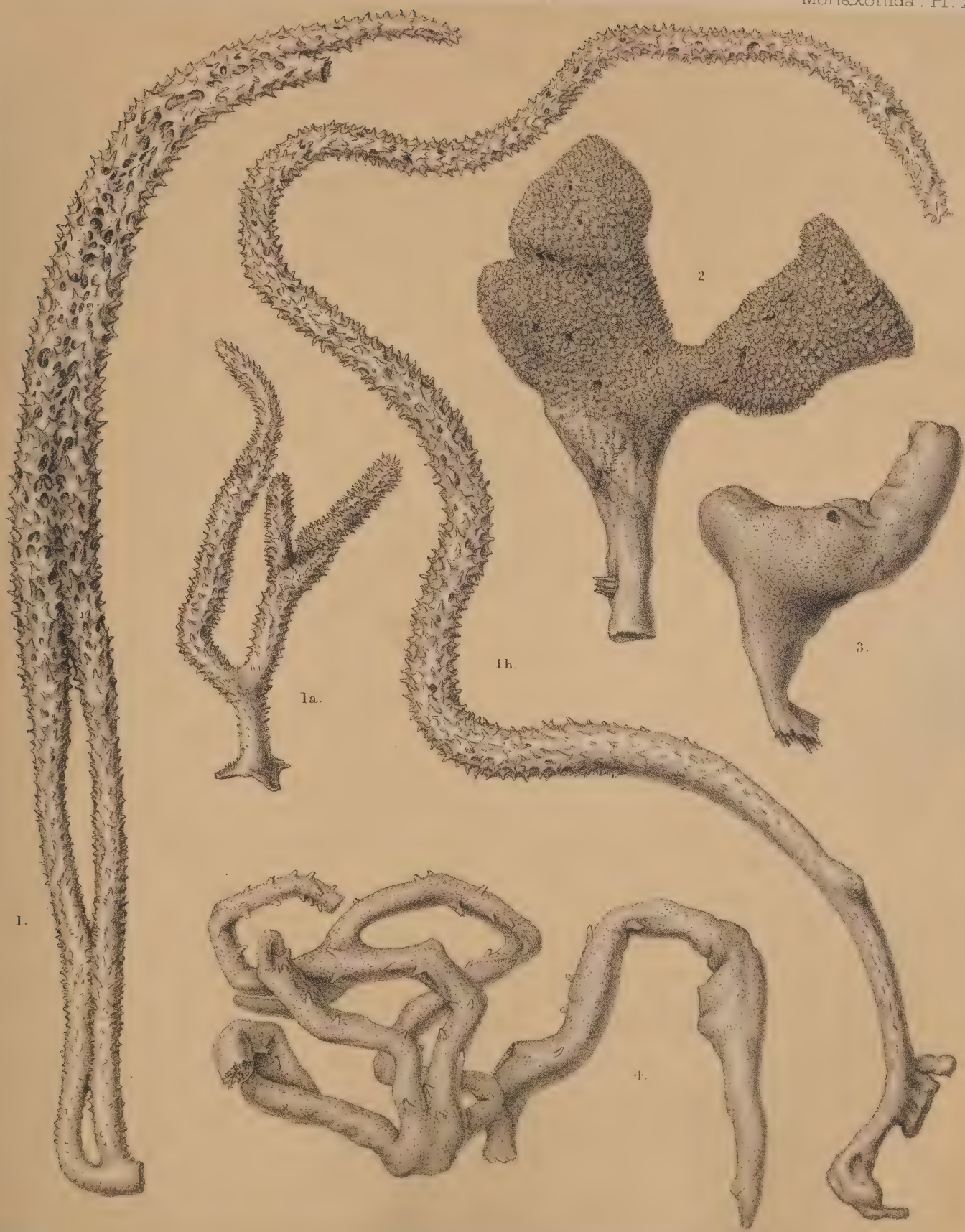
PAGE

Figs. 1, 1*a*, 1*b*. *Thrinacophora funiformis;* three specimens, showing the variation in external appearance; natural size, ... 195

Fig. 2. *Desmacidon conulosa;* natural size, ... 106

Fig. 3. *Desmacidon* (*Homœodictya*) *kerguelenensis;* natural size, . . 110

Fig. 4. *Desmacidon* (*?*) *ramosa;* natural size, ... 107



Benjeau & Highley del et lith.

Mintern Bros. imp.

THRINACOPHORA, DESMACIDON, HOMOEODICTYA,

PLATE XXV.

PLATE XXV.

PAGE

Fig. 1. *Suberites spiralis;* natural size, ... 206

Fig. 2. *Amphilectus ceratosus;* natural size, ... 125

Fig. 3. *Amphilectus pilosus* (Kerguelen); natural size, ... 126

Fig. 4. *Axinella* (?) *paradoxa; o,* oscula; natural size, ... 187

Fig. 5. *Cliona dissimilis,* pore-bearing side; natural size, . . . 227

Fig. 5*a*. Osculum-bearing side; natural size.

Fig. 5*b*. Oscula (*o*); × 3.

Fig. 5*c*. Pore-areas (*p.a.*); × 3.

Fig. 5*d*. Vertical section of the corallum, showing the spaces occupied by the sponge; natural size.

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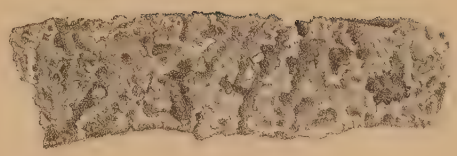

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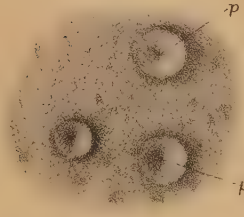

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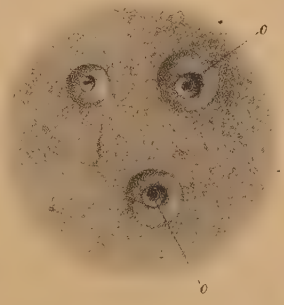

5 b × 3

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R. Morgan del et lith.

Mintern Bros. imp

CLIONA, AMPHILECTUS &c.

PLATE XXVI.

PLATE XXVI.

PAGE

Figs. 1, 1*a*. *Myxilla frondosa*, the two surfaces; natural size, . . . 144

Fig. 2. *Myxilla digitata;* natural size, ... 131

Fig. 3. *Myxilla rosacea*, var. *japonica;* natural size, ... 130

Fig. 4. *Esperiopsis symmetrica*, fragment; natural size, ... 77

Fig. 4*a*. More perfect specimen; × 2.

Figs. 5, 5*a*. *Gellius flabelliformis*, the two surfaces; natural size, . . 45

1.

1a.

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4a. x 2.

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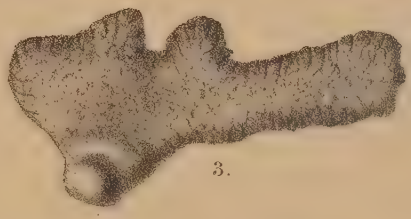

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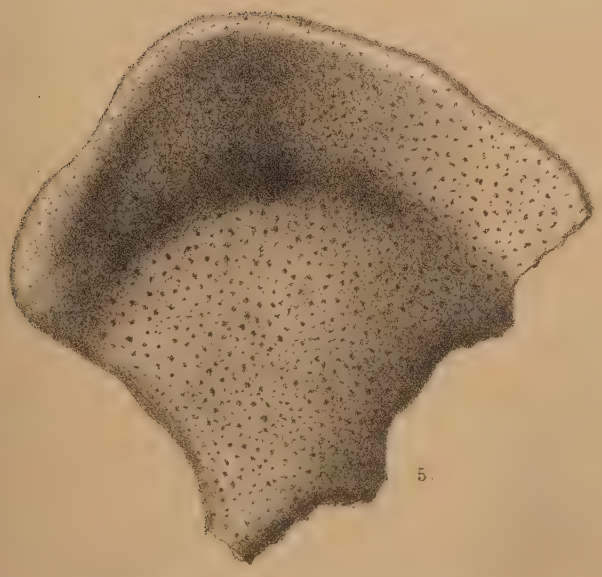

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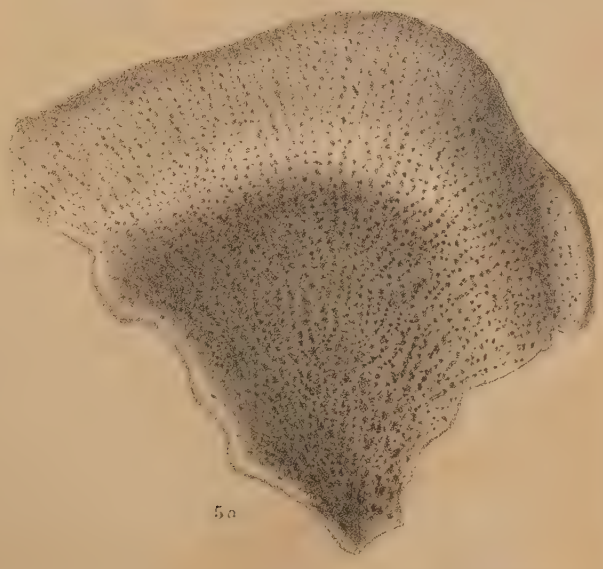

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A. Gawan del et lith.

Mintern Bros. imp.

GELLIUS, ESPERIOPSIS, MYXILLA.

PLATE XXVII.

PLATE XXVII.

PAGE

Fig. 1. *Myxilla hastata*, stylus ; × 190, ... 135
Figs. 1*a*, 1*b*. Tornota ; × 190.
Fig. 1*c*. Isochela, side view ; × 512.

Fig. 2. *Myxilla paucispinata*, stylus ; × 190, ... 132
Fig. 2*a*. Tylote spicule ; × 190.
Fig. 2*b*. Isochela, side view ; × 512.
Fig. 2*c*. Isochela, front view : × 512.

Fig. 3. *Myxilla spongiosa*, stylus ; × 190, ... 134
Figs. 3*a*, 3*b*. Tylota ; × 190.
Fig. 3*c*. Isochela, front view ; × 512.
Fig. 3*d*. Isochela, side view ; × 512.
Figs. 3*e*, 3*f*. Sigmata ; × 512.

Fig. 4. *Myxilla mollis*, stylus ; × 190, ... 133
Fig. 4*a*. Tylote spicule ; × 190.
Fig. 4*b*. Isochela, side view ; × 512.

Fig. 5. *Myxilla digitata*, spined stylus ; × 190, ... 131
Fig. 5*a*. Tylote spicule ; × 190.
Fig. 5*b*. Isochela, side view ; × 512.

Figs. 6, 6*a*. *Myxilla mariana*, var. *massa*, spined styli ; × 190, ... 139
Figs. 6*b*, 6*c*. Tylota ; × 190.
Figs. 6*d*, 6*e*. Echinating spined styli ; × 190.
Fig. 6*f*. Isochela, side view ; × 512.

Fig. 7. *Myxilla cribrigera*, stylus ; × 190, ... 136
Fig. 7*a*. Tylote spicule ; × 190.
Fig. 7*b*. Isochela, side view ; × 512.

Figs. 8, 8*a*. *Myxilla rosacea*, var. *japonica*, spined styli ; × 190, ... 130
Figs. 8*b*, 8*c*. Tornota ; × 190.

Figs. 9, 9*a*. *Myxilla compressa*, spined styli ; × 190, ... 140
Fig. 9*b*. Echinating spined stylus ; × 190
Fig. 9*c*. Tornote spicule ; × 190.
Fig. 9*d*. Isochela, front view ; × 512.
Fig. 9*e*. Isochela, side view ; × 512.

Fig. 10. *Myxilla frondosa*, spined stylus ; × 190, ... 144
Figs. 10*a*, 10*b*. Echinating spined styli ; × 190.
Figs. 10*c*, 10*d*. Tylota ; × 190.
Fig. 10*e*. Isochela, side view ; × 512.
Fig. 10*f*. Isochela, front view ; × 512.

Fig. 11. *Myxilla fusca*, spined stylus ; × 190, ... 137
Fig. 11*a*. Tylote spicule ; × 190.
Fig. 11*b*. Isochela, side view ; × 512.

Fig. 12. *Myxilla mariana*, spined stylus ; × 190, ... 138
Fig. 12*a*. Echinating spined stylus ; × 190.
Figs. 12*b*, 12*c*. Tylota ; × 190.
Fig. 12*d*. Isochela, side view ; × 512.

Fig. 13. *Myxilla nobilis*, var. *patagonica*, stylus ; × 190, ... 142
Fig. 13*a*. Tylote spicule ; × 190.
Fig. 13*b*. Echinating spined stylus ; × 190.

Fig. 14. *Myxilla nobilis*, var. *bacillifera*, stylus ; × 190, ... 143
Fig. 14*a*. Echinating spined stylus ; × 190
Fig. 14*b*. Tylote spicule ; × 190.

Fig. 15. *Myxilla nobilis*, stylus ; × 190, ... 141
Fig. 15*a*. Echinating spined stylus ; × 190.
Fig. 15*b*. Tylote spicule ; × 190.
Fig. 15*c*. Isochela side view ; × 512.
Fig. 15*d*. Isochela, front view ; × 512.

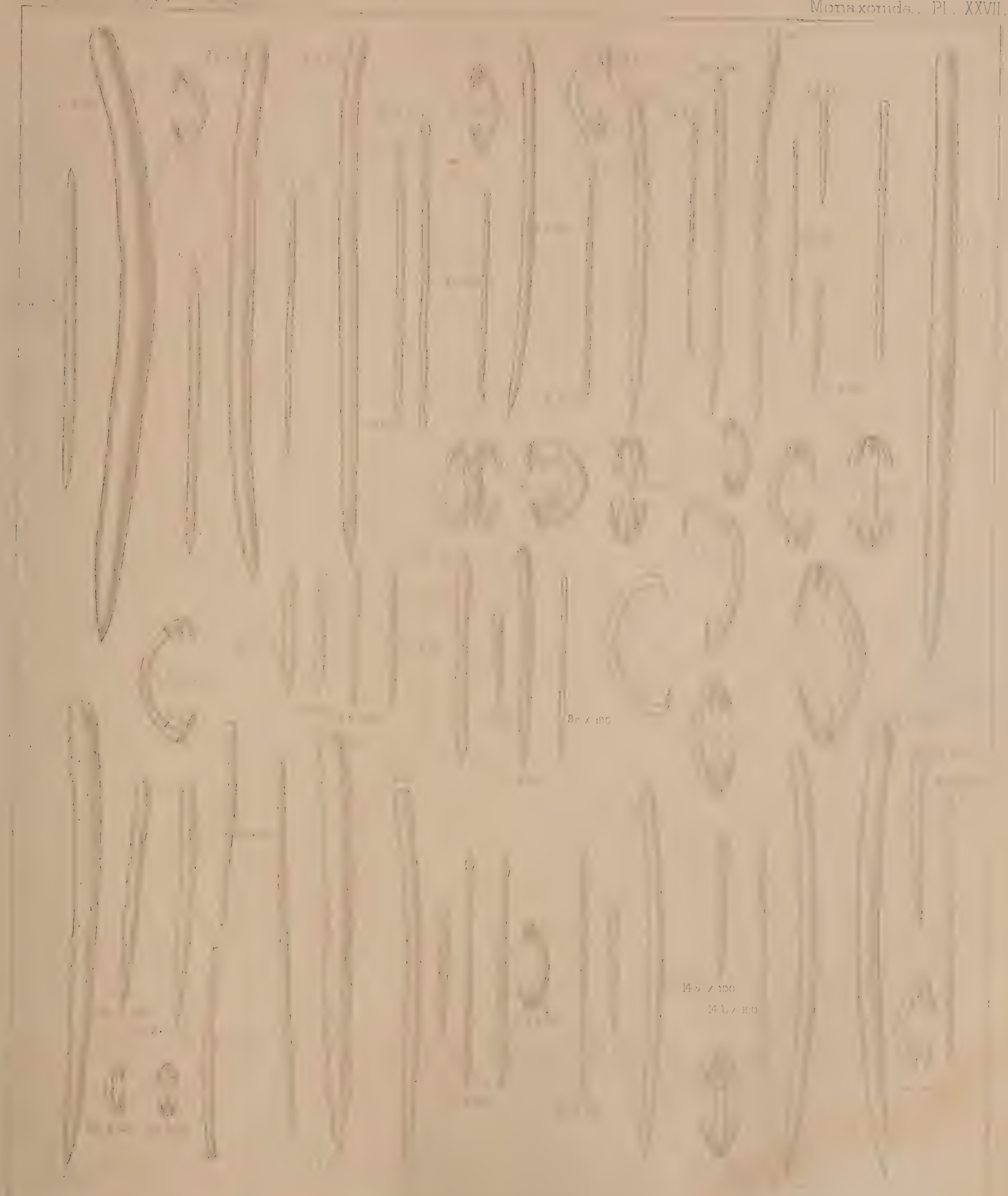

PLATE XXVIII.

PLATE XXVIII.

PAGE

Fig. 1. *Rhaphidophlus lobatus*, var. *horrida*; natural size, . . . 153

Fig. 2. *Rhaphidophlus filifer*; natural size, ... 152

Fig. 3. *Clathria elegantula*; natural size, ... 149

Fig. 3*a*. Portion of the surface, enlarged to show the parchment-like dermal membrane stretched between the prominent ridges; × 4.

Fig. 4. *Clathria inanchorata*, small specimen; natural size, . . . 150

Fig. 5. *Clathria lendenfeldi*; natural size, ... 148

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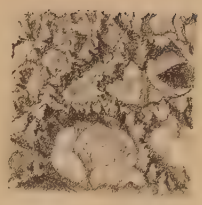

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PLATE XXIX.

PLATE XXIX.

PAGE

Fig. 1. *Tedania actiniiformis*, stylus; × 190, ... 56

Fig. 1*a*. Tornote spicule; × 190.

Fig. 2. *Tedania infundibuliformis*, stylus; × 190, ... 55

Fig. 2*a*. Tylota; × 190.

Fig. 3. *Latrunculia* (*?*) *acerata*, oxeote spicule; × 120, . . . 240

Fig. 3*a*. Strongylote spicule; × 120.
Fig. 3*b*. Discastra; × 500.

Fig. 4. *Rhaphidophlus lobatus*, var. *horrida*, stylus; × 284, . . . 154

Fig. 4*a*. Spined stylus; × 284.
Fig. 4*b*. Toxite; × 284.
Fig. 4*c*. Subtylostyli, from surface; × 284.

Fig. 5. *Suberites ramulosus*, var. *cylindrifera*, "cylindrical" spicule; × 44, . 208

Fig. 5*a*. Base and apex of "cylindrical" spicule; × 190.

Fig. 6. *Clathria lendenfeldi*, spined styli; × 284, ... 149

Fig. 7. *Desmacidon* (*Homœodictya*) *grandis*, oxeote spicule; × 190, . . 112

Fig. 7*a*. Palmate isochelæ; *a*, side view; *b*, front view; × 500.

Fig. 8. *Cliona dissimilis*, tylostyli; × 190, ... 228

Fig. 9. *Plocamia coriacea*, var. *elegans*, spined strongyla; × 284, . . 158

Fig. 10. *Agelas mauritianus*, verticillately spined styli; × 284, . . 164

Fig. 11. *Echinoclathria glabra*, tylote spicule; × 284, ... 163

Fig. 11*a*. Echinating tylostyli; × 284.

Fig. 12. *Echinoclathria carteri*, slender tylostylus; × 284, . . . 162

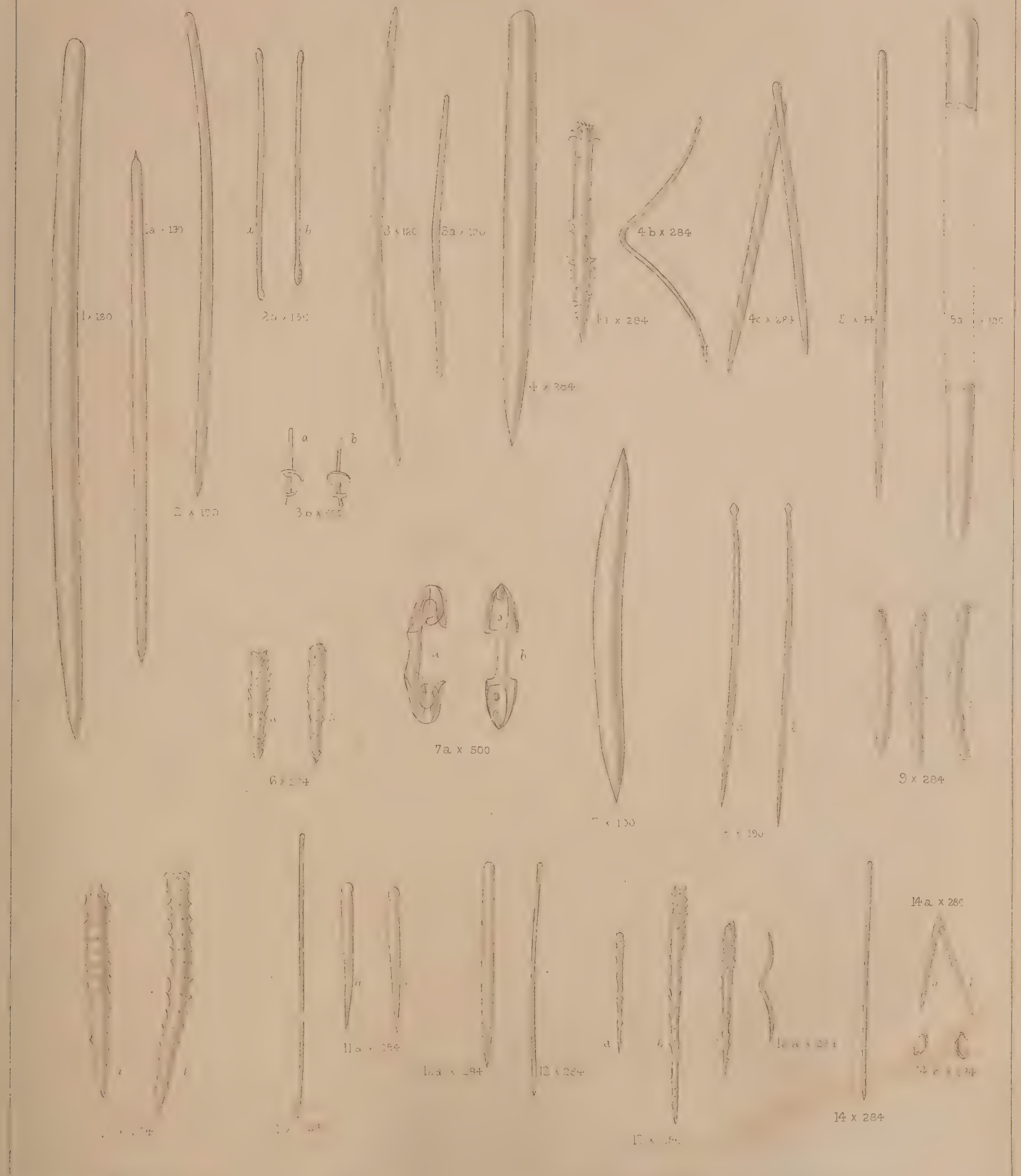
Fig. 12*a*. Echinating stylus; × 284.

Fig. 13. *Clathria inanchorata*, spined styli; × 284, ... 151

Fig. 13*a*. Toxite; × 284.

Fig. 14. *Clathria elegantula*, subtylostylus; × 284, ... 150

Fig. 14*a*. Spined styli; × 284.
Fig. 14*b*. Isochelæ, side views; × 284.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2 x 130
2a x 130
3 x 120
3a x 120
4 x 284
4b x 284
4c x 284
5 x 284
5a x 120
6 x 284
7a x 500
7 x 130
8 x 190
9 x 284
11a x 284
12 x 284
14 x 284
14a x 284

PLATE XXX.

PLATE XXX.

PAGE

Fig. 1. *Desmacidon fruticosa*, var.; natural size, ... 104

Fig. 2. *Myxilla nobilis* (Station 320); natural size, ... 140

Fig. 2*a*. Portion of surface, enlarged, showing pore-areas; × 6.

Fig. 3. *Myxilla paucispinata*, with patches (*e*) of *Esperiopsis pulchella* growing on it; natural size, ... 132

Fig. 4. *Plumohalichondria mammillata*; natural size. 156

Fig. 4*a*. Surface section, showing the pores; × 150.

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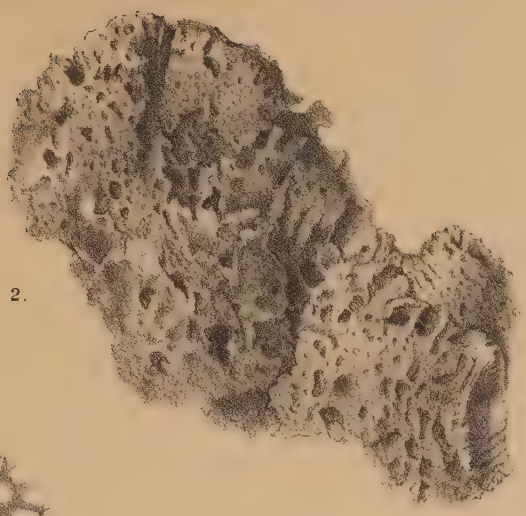

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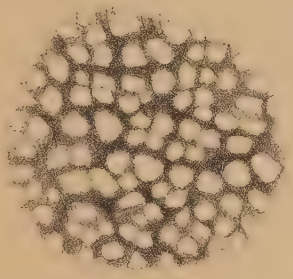

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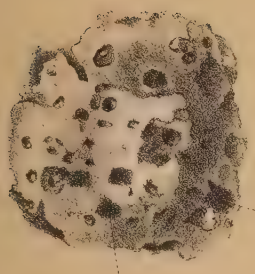

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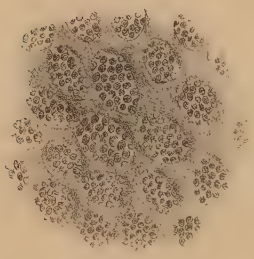

2a. x 6

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Morgan del et lith

Mintern Bros. imp

ESPERIOPSIS, DESMACIDON, MYXILLA,
PLUMOHALICHONDRIA.

PLATE XXXI.

PLATE XXXI.

PAGE

Fig. 1. *Plocamia coriacea*, var. *elegans;* × 2, ... 158

Fig. 2. *Echinoclathria glabra;* natural size, ... 163

Fig. 3. *Echinoclathria carteri;* natural size, ... 162

Fig. 3*a*. End of a branch, enlarged; *o*, oscula; × 10.

Fig. 4. *Echinoclathria favus*, growing upon a *Pecten;* natural size, . . . 160

Fig. 5. *Echinoclathria favus*, another specimen, also growing upon a *Pecten;* natural size, ... 160

Fig. 5*a*. Portion of fig. 5, enlarged, showing the oscula (*o*), and, at *m*, a delicate membrane tympanizing one of the large openings; × 5.

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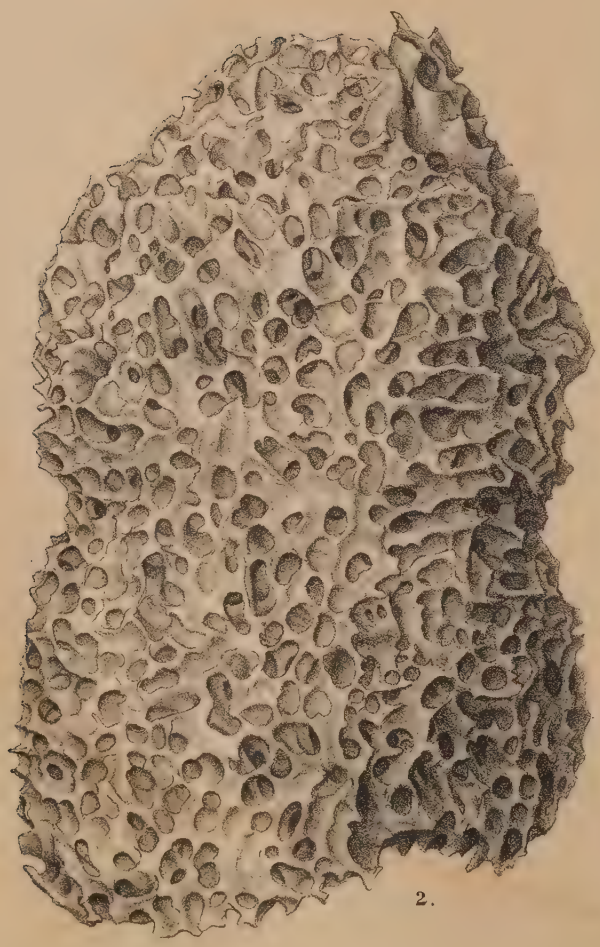
3a. x 10.



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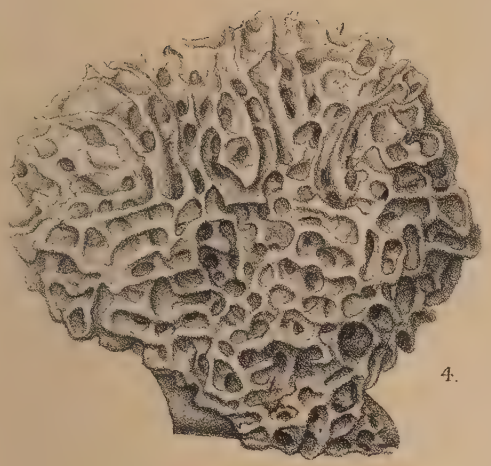
Berjeau & Highley del et lith.

PLOCAMIA,



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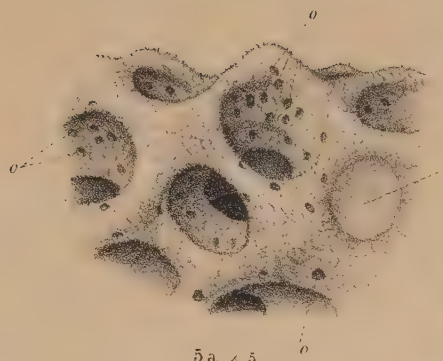

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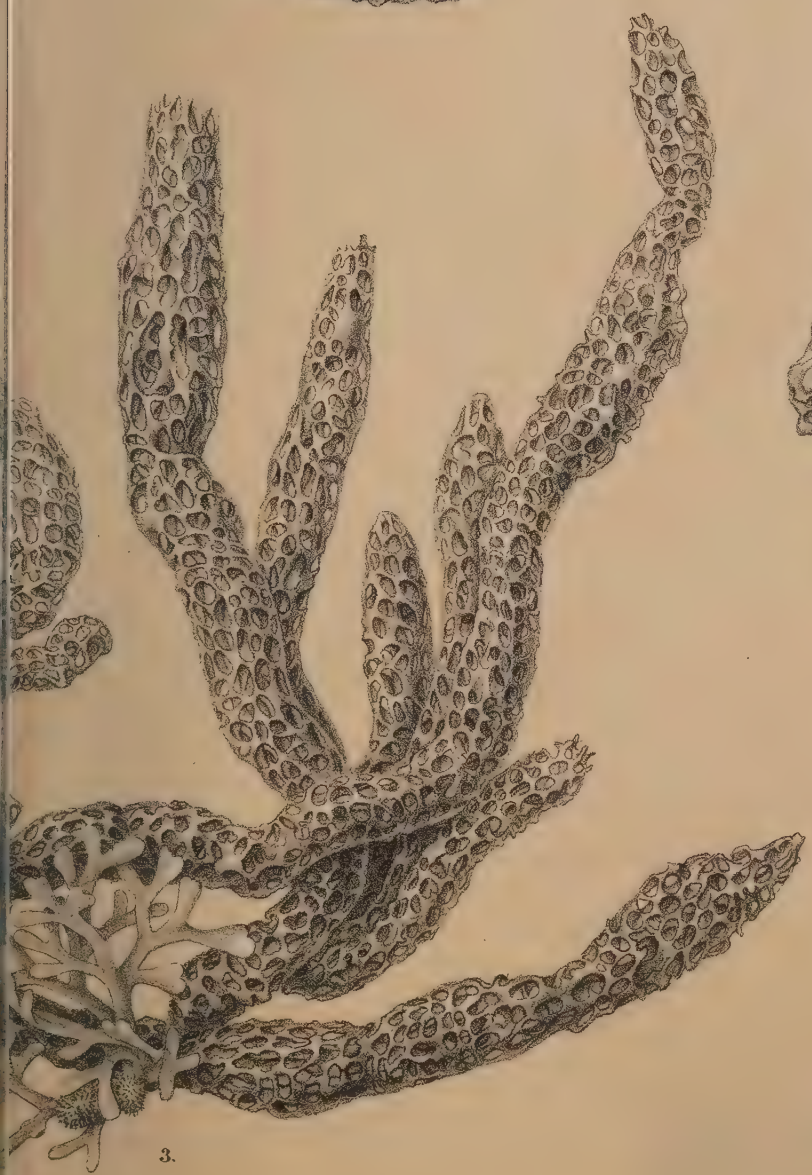

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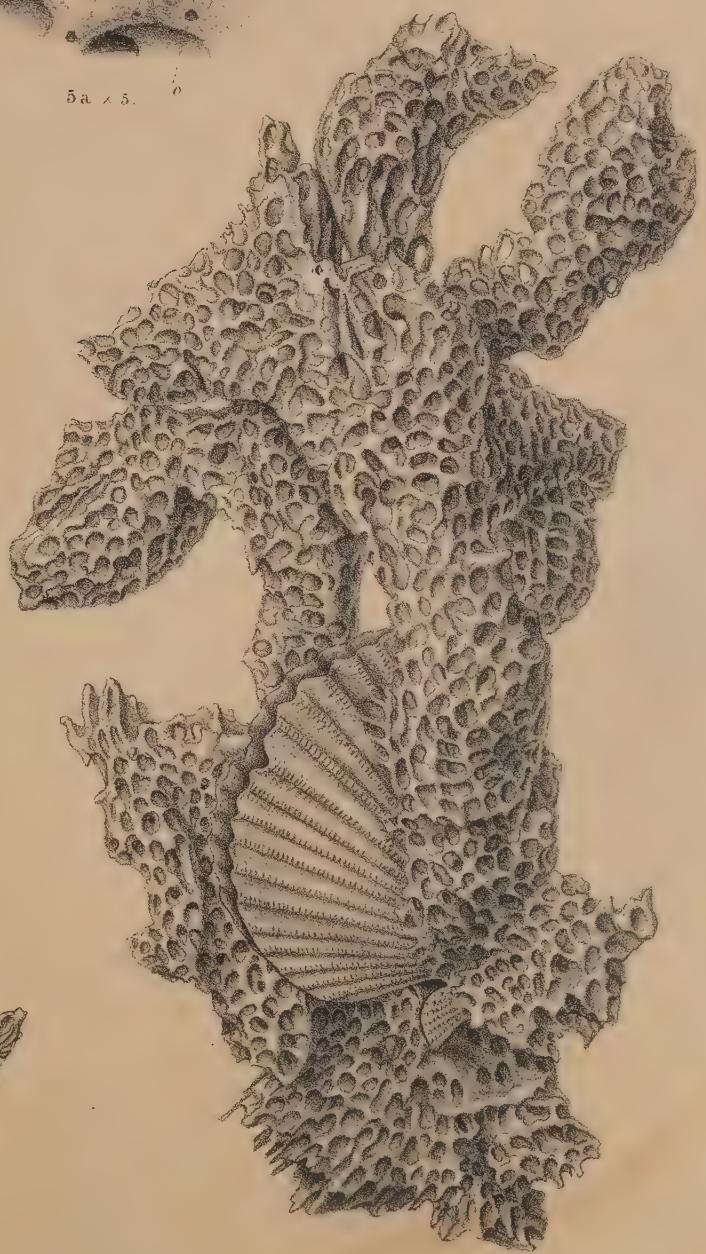

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PLATE XXXII.

PLATE XXXII.

PAGE

Fig. 1. *Echinodictyum rugosum;* natural size, ... 165

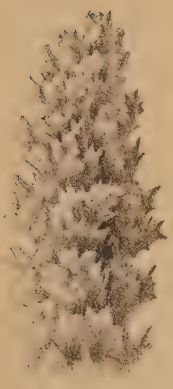
Fig. 1*a*. End of a branch; × 3

Fig. 2. *Echinodictyum asperum*, attached to a stone: natural size. . . 165

Fig. 3. *Acanthella pulcherrima;* natural size, ... 177

1

3



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A. Gawan del et lith.

Mintern Bros. imp.

ECHINODICTYUM, ACANTHELLA.

PLATE XXXIII.

PLATE XXXIII.

PAGE

Fig. 1. *Axinella balfourensis;* natural size, ... 179

Fig. 2. *Ciocalypta hyaloderma;* natural size, ... 174

Fig. 2*a*. Portion of surface, with oscular projection; × 3.

Fig. 3. *Hymeniacidon caruncula;* natural size, ... 167

A. Gewan del et lith.

Mintern Bros. imp

HYMENIACIDON, CIOCALYPTA.
AXINELLA.

PLATE XXXIV.

PLATE XXXIV.

PAGE

Fig. 1. *Axinella mariana;* natural size, ... 180

Fig. 2. *Phakellia flabellata,* surface without oscula; natural size, . . 171

Fig. 3. *Phakellia flabellata,* another specimen, surface without oscula; natural size, ... 171

Fig. 3*a*. Portion of osculum-bearing surface, showing the stellate oscula; × 2.

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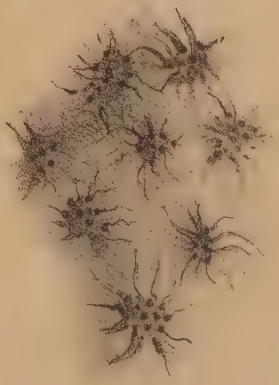

3a ·2

G.M.Herschell del. et lith.

PHAKELLIA, AXINELLA.

West, Newman & Co. imp.

PLATE XXXV.

PLATE XXXV.

PAGE

Fig. 1. *Axinella erecta* (off Nightingale Island, Tristan da Cunha); natural size, ... 183

Figs. 2, 2*a*, 2*b*, 2*c*. *Axinella erecta*, a series of small specimens (Station 148A); natural size, ... 182

Fig. 3. *Phakellia ventilabrum*, var. *connexiva*; × $\frac{2}{3}$, ... 170

Fig. 3*a*. Portion of osculum-bearing surface of same specimen, to show oscula; × 2.

Fig. 4. *Axinella arborescens*; × $\frac{2}{3}$, ... 178

Fig. 4*a*. Portion of a branch; × 2.

PHAKELLIA, AXINELLA.

PLATE XXXV.

PLATE XXXV.

PAGE

Fig. 1. *Axinella erecta* (off Nightingale Island, Tristan da Cunha); natural size, ... 183

Figs. 2, 2*a*, 2*b*, 2*c*. *Axinella erecta*, a series of small specimens (Station 148A); natural size, ... 182

Fig. 3. *Phakellia ventilabrum*, var. *connexiva*; × $\frac{2}{3}$, ... 170

Fig. 3*a*. Portion of osculum-bearing surface of same specimen, to show oscula; × 2.

Fig. 4. *Axinella arborescens*; × $\frac{2}{3}$, ... 178

Fig. 4*a*. Portion of a branch; × 2.

PHAKELLIA, AXINELLA.

PLATE XXXVI.

PLATE XXXVI.

Fig. 1. *Thrinacophora cervicornis;* natural size, ... 194

Fig. 2. *Axinella erecta* (Inaccessible Island); *a*, parasitic Alcyonarians; natural size, ... 182

Fig. 3. *Axinella echidnæa;* natural size, ... 183

Fig. 4. *Phakellia papyracea*, portion only of specimen (Station 145A); natural size, ... 172

A. Gawan del et lith. Mintern Bros. imp.

AXINELLA, PHAKELLIA, THRINACOPHORA.

PLATE XXXVII.

PLATE XXXVII.

PAGE

Fig. 1. *Axinella lunæcharta;* natural size, ... 186

Fig. 1*a*. One of the crateriform projections, showing a small osculum; × 3.

Fig. 2. *Axinella lunæcharta,* another specimen; natural size, . . . 186

Fig. 3. *Axinella fibrosa;* natural size, ... 183

Fig. 4. *Axinella reticulata;* natural size, ... 184

Fig. 4*a*. Portion of surface; × 4.

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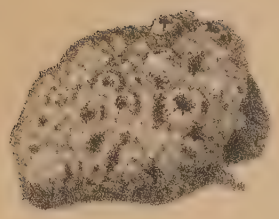

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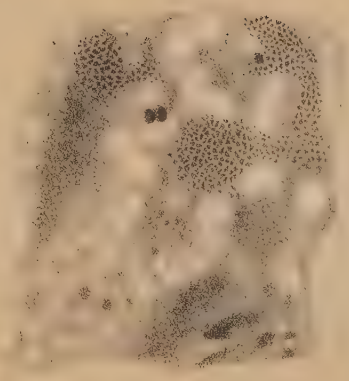

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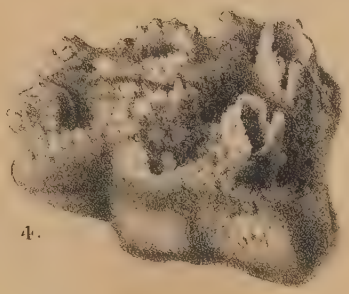

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PLATE XXXVIII.

PLATE XXXVIII.

PAGE

Fig. 1. *Dendropsis bidentifera;* natural size, ... 192

Fig. 2. *Axinella profunda* (Station 241); natural size. 181

Fig. 3. *Axinella profunda* (Station 281); natural size, ... 181

Fig. 4. *Axinella* (?) *tubulosa;* natural size, ... 187

Fig. 5. *Axinella monticularis;* natural size, ... 185

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DENDROPSIS, AXINELLA.

PLATE XXXIX.

PLATE XXXIX.

PAGE

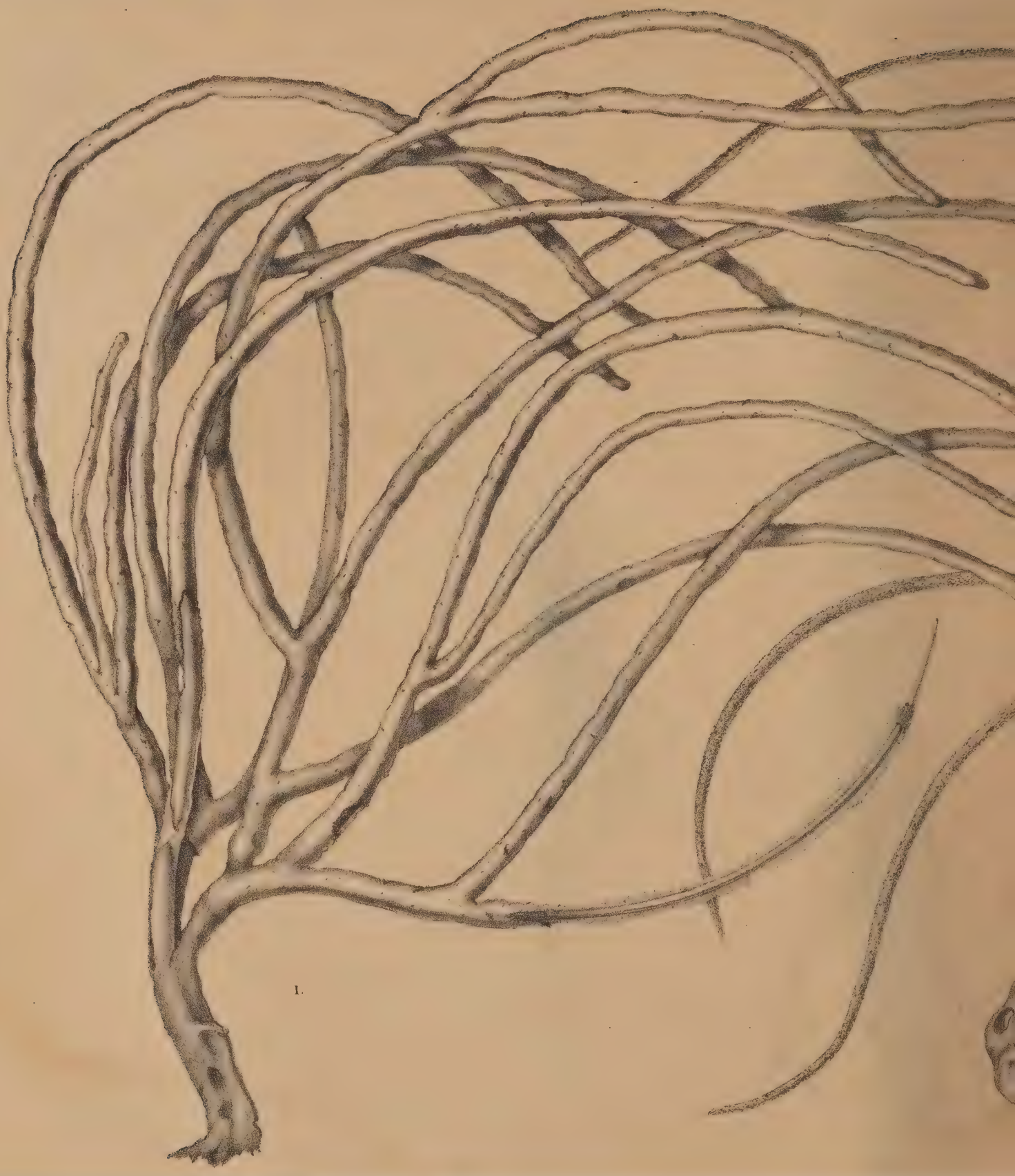
Fig. 1. *Raspailia flagelliformis;* natural size, ... 190

Fig. 2. *Raspailia tenuis;* natural size, ... 188

Fig. 2*a*. Portion of branch, enlarged, showing oscula; × 3.

Fig. 3. *Raspailia* (?) *rigida;* natural size, ... 191

Fig. 4. *Hymeniacidon* (?) *subacerata;* natural size, ... 168



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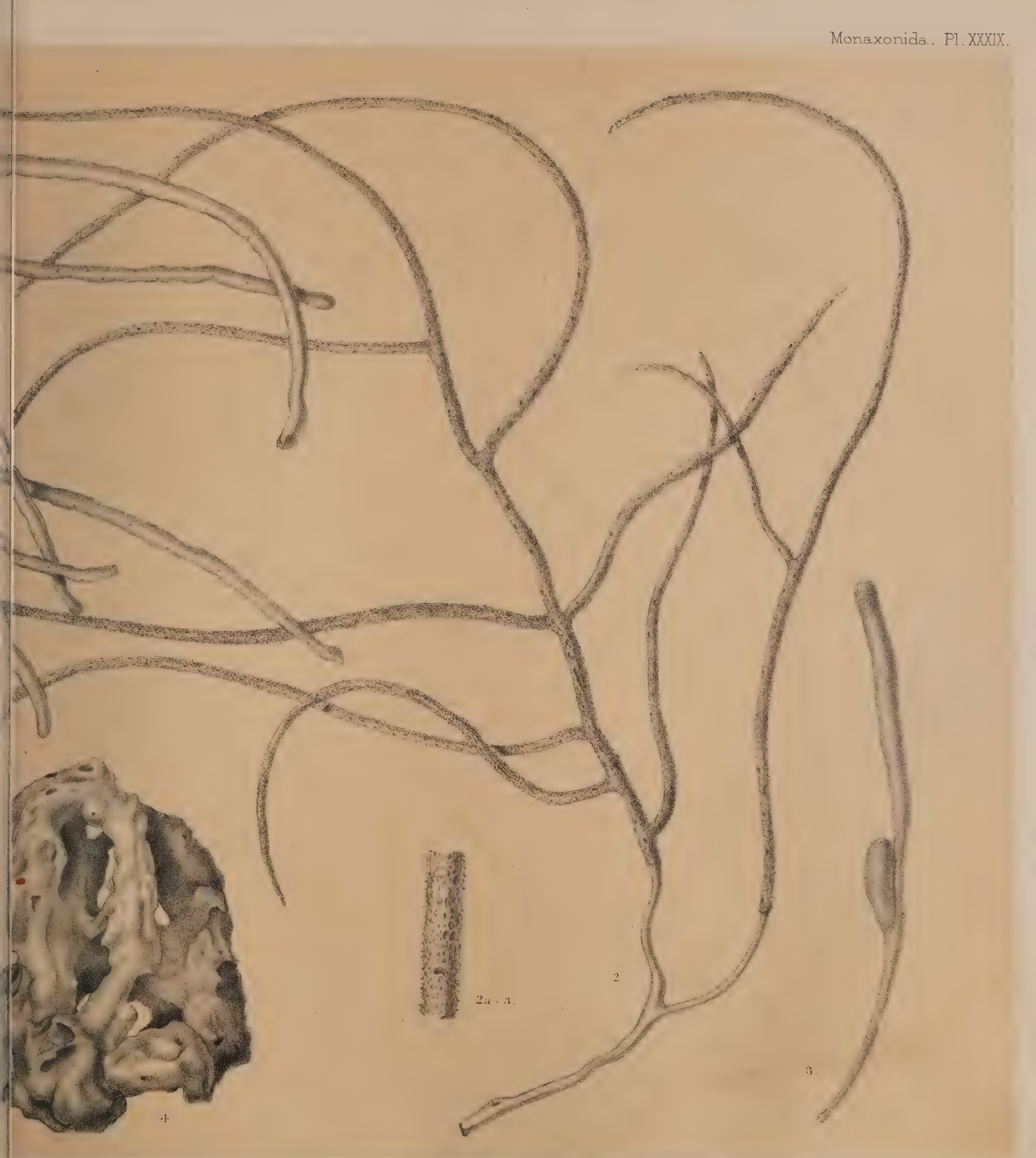
R. Morgan del et lith.

RASPAILIA.



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MENIACIDON (?).

PLATE XL.

PLATE XL.

PAGE

Fig. 1. *Axinella erecta* (Station 148A), styli; × 44, ... 182

Fig. 1*a*. Crooked strongyla ("vermicular" spicules); × 44.

Fig. 2. *Axinella mariana*; *a*, *a*, large subtylostylus and stylus; *b*, small styli; × 44, ... 180

Fig. 3. *Axinella profunda*, subtylostyli; × 66, ... 181

Fig. 3*a*. Bases of subtylostyli; × 284.

Fig. 4. *Thrinacophora cervicornis*; *a*, stylus, from one of the surface brushes; *b*, oxeote spicule; × 190, ... 194

Fig. 4*a*. Trichodragmata; × 190.

Fig. 5. *Hymeniacidon* (?) *subacerata*, styli; × 66, ... 169

Fig. 5*a*. Base and apex of stylus; × 190.

Fig. 6. *Phakellia flabellata*, large styli; × 190, ... 171

Fig. 6*a*. Small styli from surface tuft; × 190.

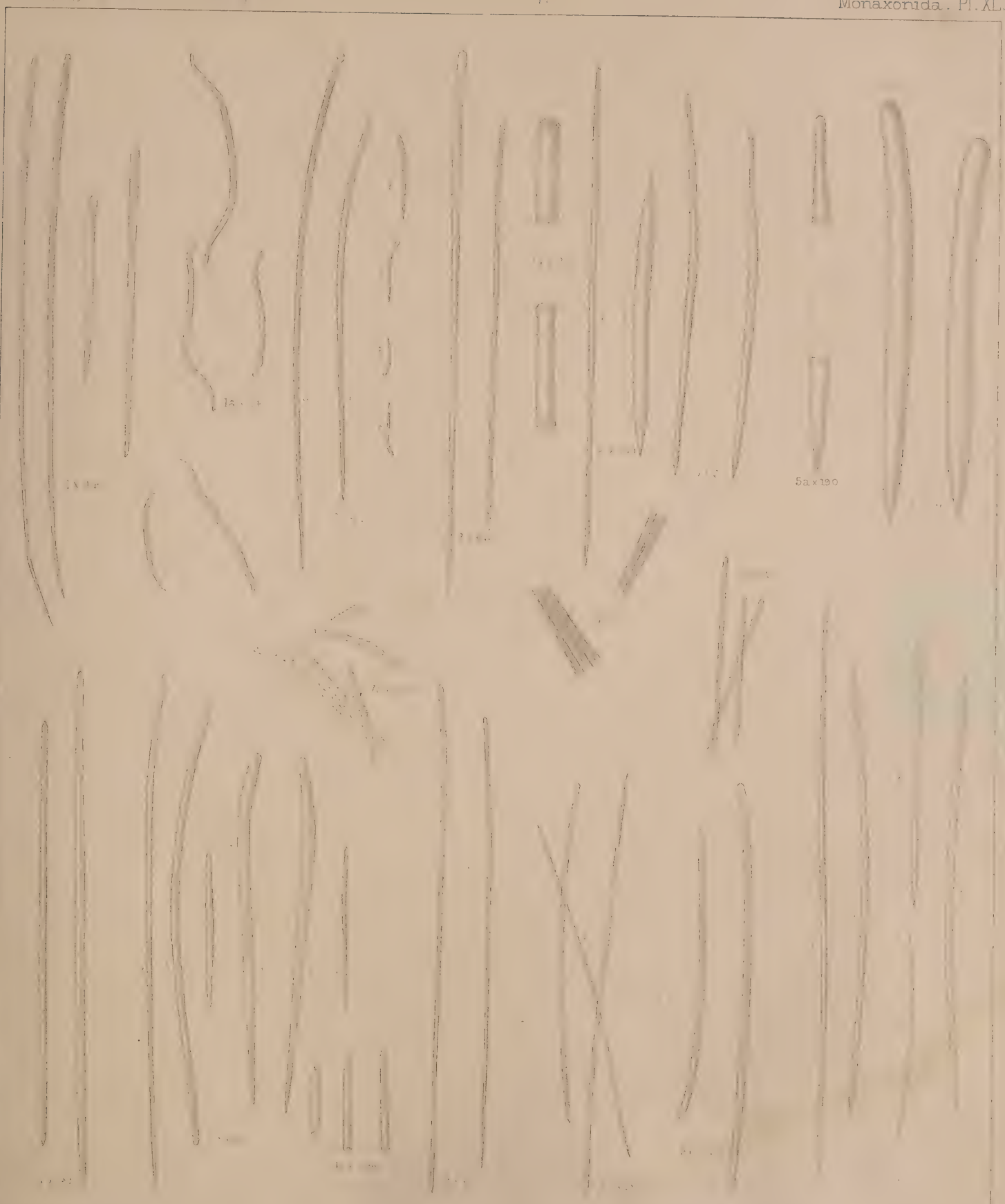
Fig. 7. *Dendropsis bidentifera*; *a*, styli; *b*, strongylote spicule; *c*, stylus with spined base; × 66, ... 192

Fig. 7*a*. Two basally spined styli; × 190.
Fig. 7*b*. Bases of three of the basally spined styli; × 284.
Fig. 7*c*. Spined oxea; × 284.

Fig. 8. *Raspailia tenuis*, two of the large styli; × 66, ... 189

Fig. 8*a*. *a*, styli; *b*, oxeote spicule; × 190.
Fig. 8*b*. Strongyla; × 190.

Fig. 9. *Ciocalypta amorphosa*; *a*, oxea; *b*, styli; × 66, . . . 176



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AXINELLIDAE.

PLATE XLI.

PLATE XLI.

PAGE

Fig. 1. *Suberites durissimus;* natural size, ... 203

Fig. 2. *Suberites caminatus*, group of specimens encrusting a fragment of *Sporadopora* (Station 320); natural size, ... 199

Fig. 3. *Suberites microstomus;* natural size, ... 199

Fig. 4. *Suberites mollis;* × $\frac{3}{2}$, ... 204

Fig. 5. *Spirastrella papillosa;* × $\frac{2}{3}$, ... 232

Fig. 6. *Polymastia agglutinans;* × 2, ... 212

Fig. 7. *Spirastrella solida;* natural size, ... 231

Fig. 8. *Polymastia robusta;* natural size, ... 210

Fig. 9. *Suberites perfectus;* natural size, ... 200

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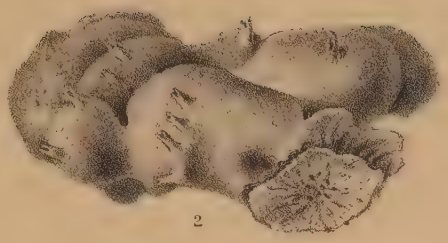

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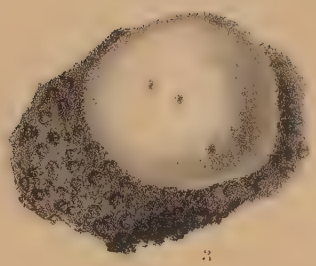

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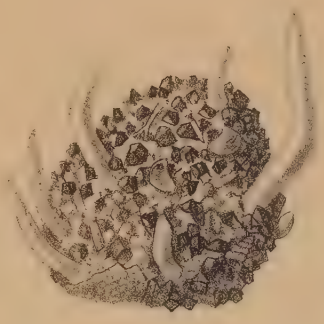

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SUBERITES, POLYMASTIA, SPIRASTRELLA.

PLATE XLII.

PLATE XLII.

PAGE

Fig. 1. *Polymastia agglutinans*, vertical section, showing the arrangement of the skeleton; *a*, cortical layer of spicules; *b*, grains of sand; *c*, main skeleton fibres; *d*, small, scattered spicules; × 45, . . . 213

Fig. 2. *Polymastia agglutinans*, large stylus from the body of the sponge; × 120, 213

Figs. 2*a*, 2*b*. Small tylostyli, found scattered in the soft tissues; × 284.

Fig. 3. *Polymastia agglutinans*, transverse section of one of the long, mammiform projections, showing the arrangement of the skeleton; *a*, cortical layer of spicules; *b*, subjacent layer of spicules; *c*, longitudinal bands of spiculo-fibre, seen in section; *d*, zone of small spicules scattered around *e*, the large central canal; × 40, ... 213

Fig. 4. *Polymastia corticata*, vertical section, showing the arrangement of the skeleton; *a*, brushes of spicules in the outermost layer of the cortex; *b*, large, longitudinally placed spicules in the lower layer of the cortex; *c*, choanosome; × 45, ... 212

Fig. 5. *Polymastia corticata*, large stylus; × 66, ... 212

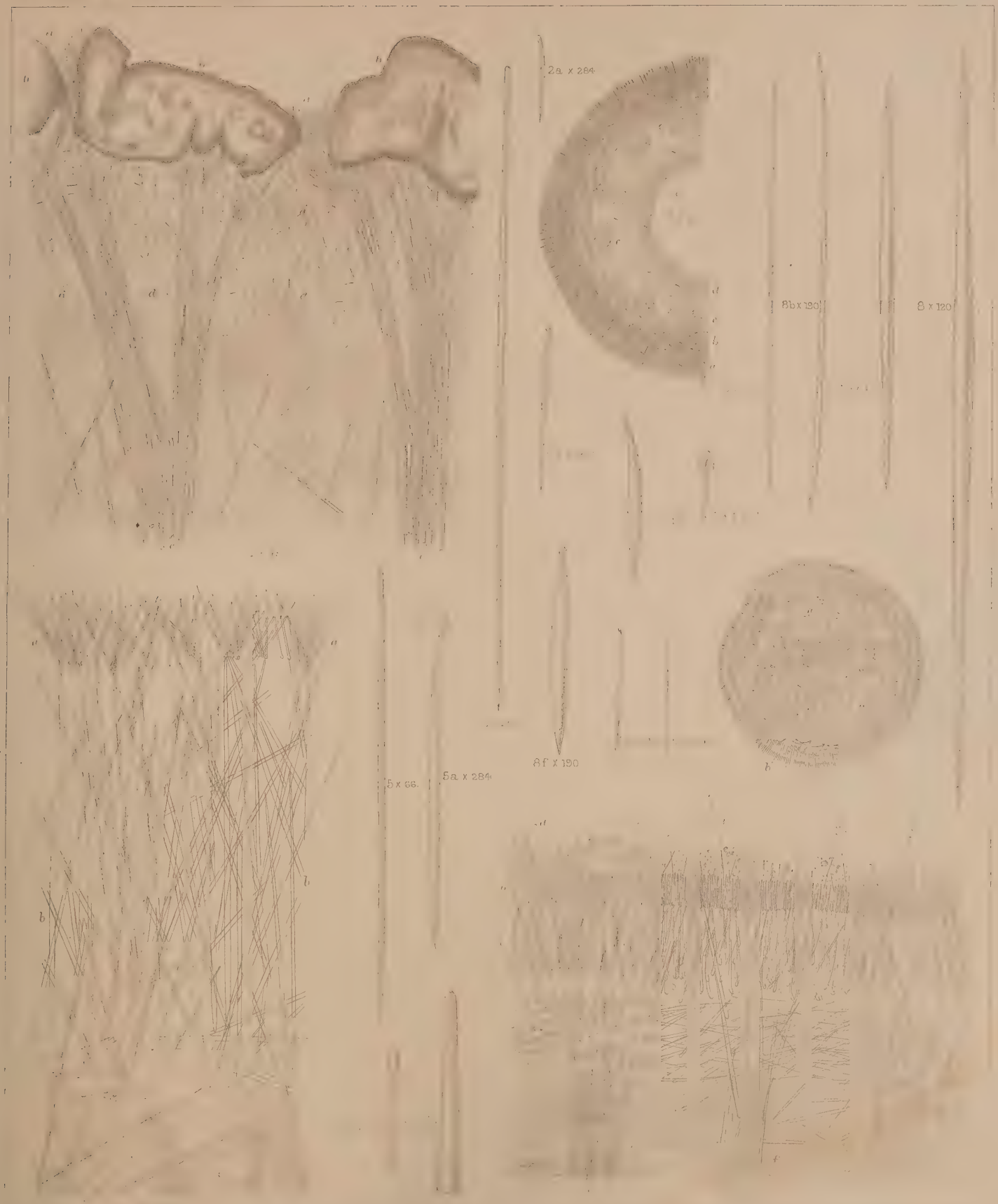
Fig. 5*a*. Tylostylus from outermost layer of cortex; × 284.
Figs. 5*b*, 5*c*. Bases of two spicules from the inner layer of the cortex; × 284.

Fig. 6. *Proteleia sollasi*, vertical section of body, showing the arrangement of the skeleton; *a*, primary fibres; *b*, outermost layer of cortical spicules; *c*, subjacent layer of cortical spicules; *d*, grapnel spicules; *e*, accumulation of foreign matter on the surface; *f*, choanosome, with scattered spicules; × 44, ... 215

Fig. 7. *Proteleia sollasi*, transverse section of one of the mammiform processes, showing the arrangement of the skeleton; *a*, longitudinal bands of spiculo-fibre, seen in section; *b*, outermost layer of cortical spicules; *c*, subjacent layer of cortical spicules; × 12, ... 215

Fig. 8. *Proteleia sollasi*, large stylus; × 120, ... 216

Fig. 8*a*. Smaller stylus; × 190.
Fig. 8*b*. Grapnel spicule; × 190.
Fig. 8*c*. Grapnel spicule, with terminal expansion but no teeth; × 190.
Fig. 8*d*. Free end of grapnel spicule; × 500.
Figs. 8*e*, 8*f*. Large tylostyli; × 190.
Figs. 8*g*, 8*h*. Small tylostyli; × 190.



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POLYMASTIA, PROTELEIA.

PLATE XLIII.

PLATE XLIII.

PAGE

Fig. 1. *Trichostemma sarsii* (Station 73), seen from above; × 2, . . 218

Fig. 1*a*. Same specimen, side view; × 2.

Fig. 2. *Trichostemma sarsii*, another specimen (Station 73), seen from above; × 2, ... 218

Fig. 2*a*. Same specimen, side view; × 2.

Fig. 3. *Trichostemma sarsii* (Station 184), seen from above; × 2, . . 218

Fig. 3*a*. Same specimen, side view; × 2.

Fig. 4. *Trichostemma irregularis*, seen from above; × 2, . . . 220

Fig. 4*a*. Same specimen, side view; × 2.

Fig. 5. *Trichostemma irregularis*, another specimen, side view; × 2, . . 220

Fig. 6. *Stylocordyla stipitata* (Station 49); × 2, ... 223

Figs. 7, 8, 9. *Stylocordyla stipitata* (Station 147); × 2, . . . 223

Fig. 10. *Stylocordyla stipitata*, var. *globosa* (Kerguelen); natural size, . . 224

Figs. 11, 12. *Suberites elongatus*; × 2, ... 205

Figs. 13, 14. *Suberites ramulosus*, var. *cylindrifera*; natural size, . . 208

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SUBERITES, TRICHOSTEMMA, STYLOCORDYLA.

PLATE XLIV.

PLATE XLIV.

PAGE

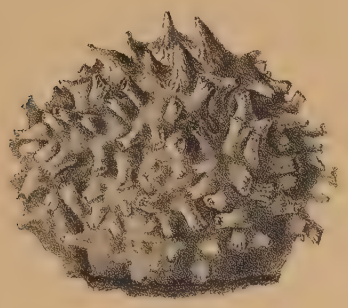
Fig. 1. *Latrunculia bocagei;* natural size, ... 238

Fig. 2. *Proteleia sollasi;* natural size, ... 214

Fig. 3. *Polymastia corticata;* natural size, ... 211

Fig. 4. *Latrunculia apicalis* (Kerguelen); *p.a.*, raised pore-areas; *o*, oscula; natural size, ... 234

Fig. 5. *Latrunculia brevis*, growing upon a fragment of *Sporadopora;* natural size, 236



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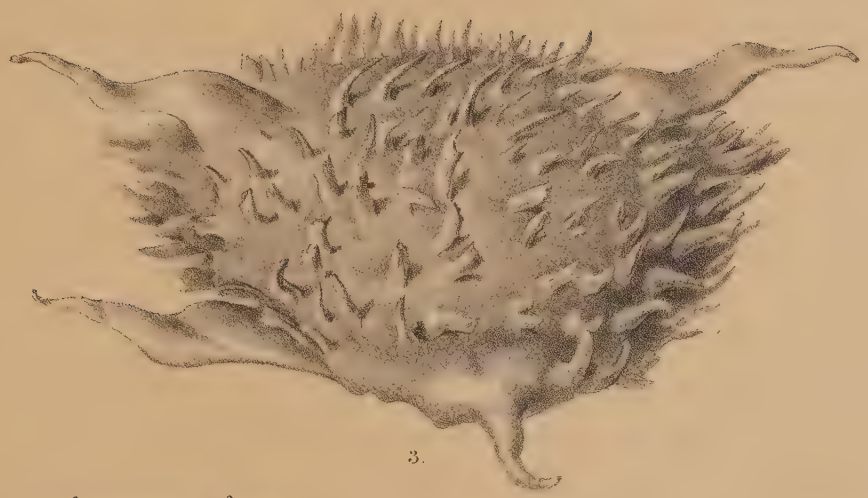

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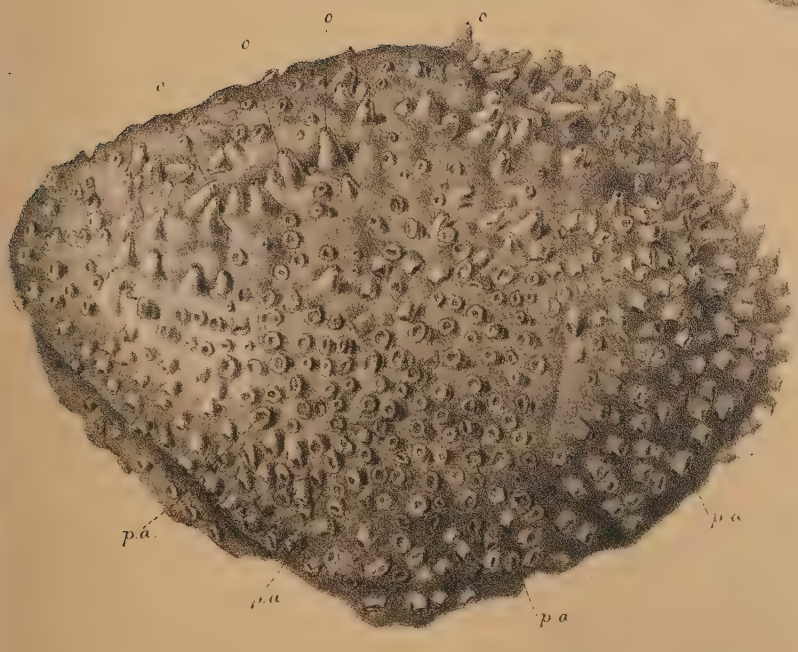

4.

5.

PLATE XLV.

PLATE XLV.

PAGE

Fig. 1. *Suberites senilis*, large tylostylus; × 66, ... 209
Fig. 1*a*. Smaller tylostylus; × 190.
Fig. 1*b*. Part of large tylostylus; × 190.

Fig. 2. *Suberites durissimus*, large subtylostylus; × 66, . . . 204
Figs. 2*a*, 2*b*, 2*c*. Smaller tylostyli; × 190.
Figs. 2*d*, 2*e*. Bases of larger spicules; × 190.

Fig. 3. *Suberites perfectus*, large tylostylus; × 66, ... 201
Fig. 3*a*. Smaller tylostylus; × 190.
Fig. 3*b*. Base of larger tylostylus; × 190.

Figs. 4, 4*a*. *Suberites mollis*, large tylostyli (fig. 4*a*, a portion only); × 66, . 205
Fig. 4*b*. Base of large tylostylus; × 190.
Fig. 4*c*. Smaller tylostylus; × 190.

Fig. 5. *Suberites caminatus*, large tylostylus; × 66, ... 198
Figs. 5*a*, 5*b*. Smaller tylostyli; × 190.
Figs. 5*c*, 5*d*. Bases of large tylostyli; × 190.

Fig. 6. *Hymeniacidon* (?) *hyalina*, large tylostylus; × 66, . . . 168
Fig. 6*a*. Base of large tylostylus; × 190.
Fig. 6*b*. Smaller tylostylus; × 190.

Fig. 7. *Suberites antarcticus*, large tylostylus; × 66, ... 202
Figs. 7*a*, 7*b*. Bases of large tylostyli; × 190.
Figs. 7*c*, 7*d*. Smaller tylostyli; × 190.

Fig. 8. *Latrunculia bocagei*, stylus; × 190, ... 238
Fig. 8*a*. Discaster; × 280.

Fig. 9. *Latrunculia apicalis* (Station 320), stylus; × 190, . . . 235
Fig. 9*a*. Discaster; × 280.
Fig. 9*b*. Large whorl of discaster, full view; × 280.
Fig. 9*c*. Discaster (Kerguelen); × 280.

Fig. 10. *Latrunculia brevis*, stylus; × 190, ... 237
Fig. 10*a*. Discaster; × 280.

Fig. 11. *Spirastrella papillosa*, larger tylostylus; × 190, . . . 233
Figs. 11*a*, 11*b*. Smaller tylostylus and subtylostylus, from surface; × 190.
Figs. 11*c*–11*g*. Spined spirulæ; × 500.

Fig. 12. *Spirastrella decumbens*, tylostylus; × 190, ... 229
Figs. 12*a*–12*g*. Spined spirulæ; × 500.

Fig. 13. *Spirastrella solida*, tylostylus; × 190, ... 231
Figs. 13*a*–13*e*. Spined spirulæ; × 500.

Figs. 14, 14*a*, 14*b*. *Spirastrella massa*, subtylostyli and stylus; × 190, . 230
Figs. 14*c*–14*k*. Spined spirulæ; × 500.

Fig. 15. *Suberites axiatus*, large tylostylus; × 66, ... 203
Fig. 15*a*. Smaller tylostylus; × 190.
Figs. 15*b*, 15*c*. Bases of two of the larger tylostyli; × 190.

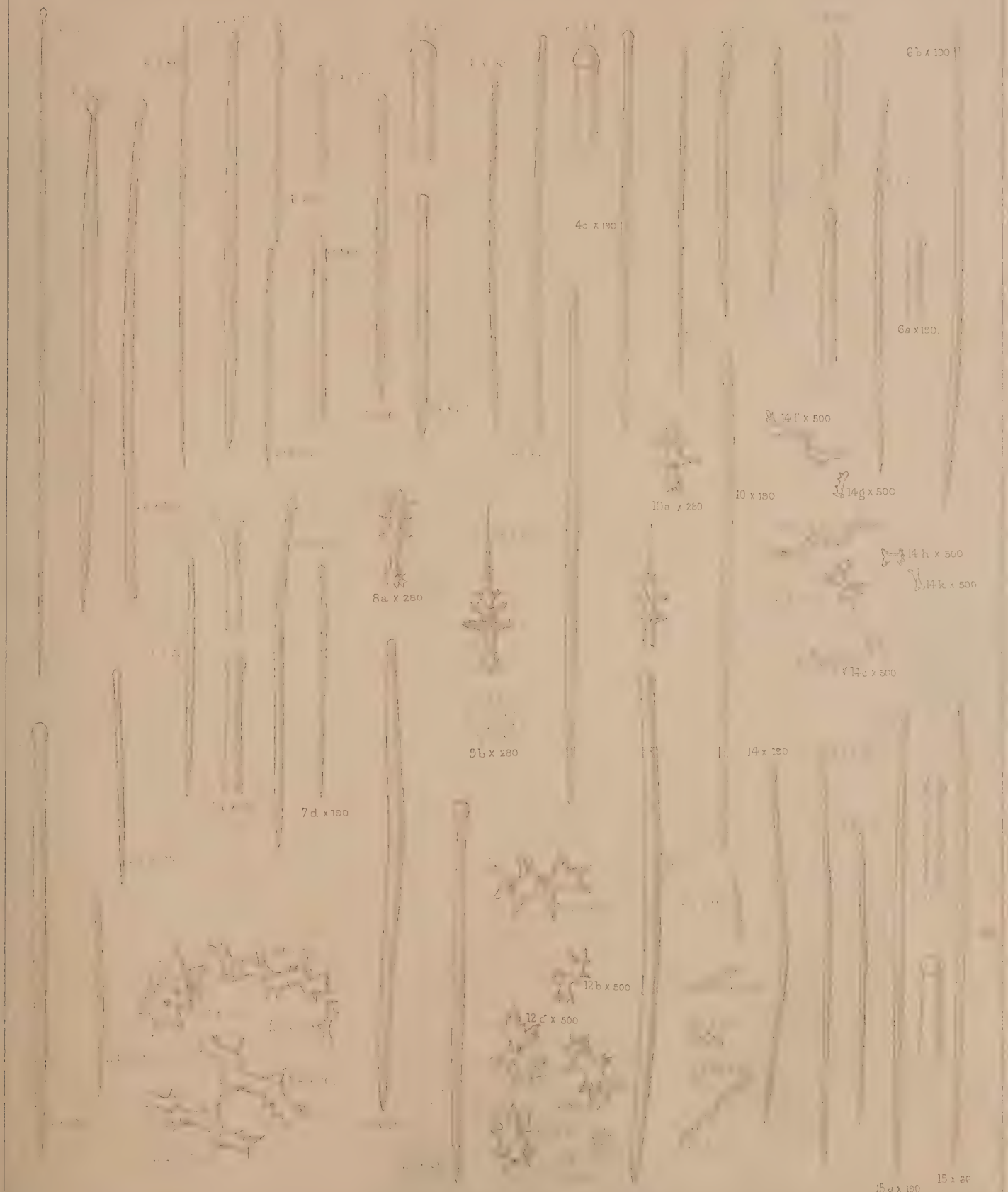

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PLATE XLVI.

PLATE XLVI.

PAGE

Fig. 1. *Pachychalina* (*?*) *punctata*, dermal skeleton reticulation surrounding *p*, one of the pores (?); *pr*, projection into the pore, ... 24

Fig. 2. *Pachychalina* (*?*) *punctata*, skeleton arrangement, as seen in vertical section, 24

Fig. 3. *Siphonochalina intermedia*, skeleton arrangement, as seen in vertical section; *a*, primary fibres; *b*, secondary fibres, ... 30

Fig. 4. *Pachychalina lobata*, surface section, showing the dermal skeleton reticulation and the pores; *d.s.*, dermal skeleton; *d.m.*, dermal membrane; *p*, pores, ... 22

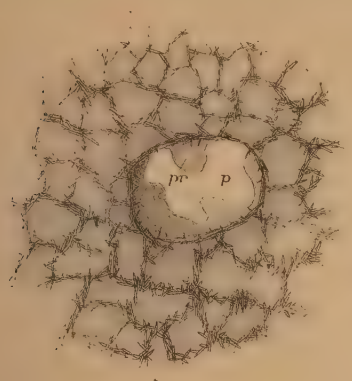
Fig. 5. *Halichondria latrunculioides*, dermal skeleton, ... 6

Fig. 6. *Chalina rectangularis*, skeleton arrangement, as seen in vertical section, . 28

Fig. 7. *Esperiopsis symmetrica*, skeleton arrangement, as seen in longitudinal vertical section; *a–a*, imaginary long axis of sponge; *b*, a band of spiculo-fibre of the inner series; *c*, a band of spiculo-fibre of the outer series; *d*, radiating fibres (part only shown); *e*, embryos, . . 77

Fig. 8. *Dendropsis bidentifera*, skeleton arrangement, as seen in transverse section; *a*, central axis; *b*, tufts of small spicules surrounding the large projecting spicules; *c*, small, spined oxea, ... 192

Fig. 9. *Rhaphidophlus filifer*, skeleton arrangement, as seen in vertical section; *d.c.*, the characteristic dermal crust of spicules, ... 152



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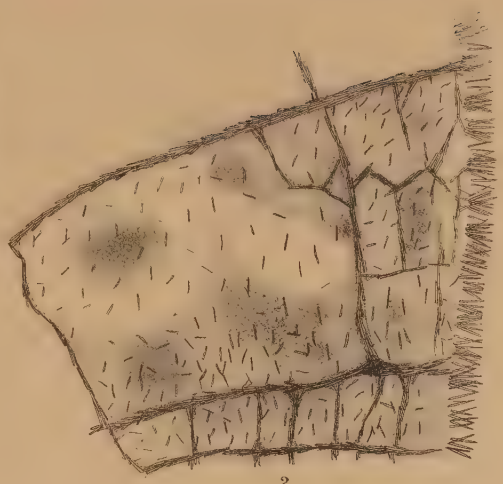

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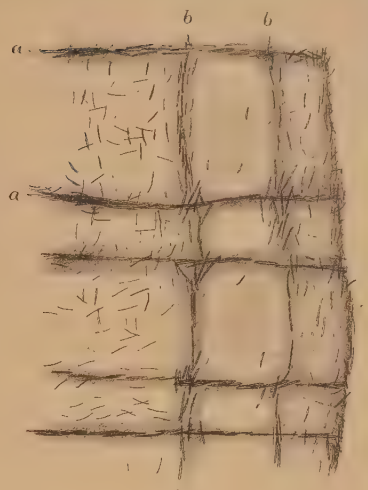

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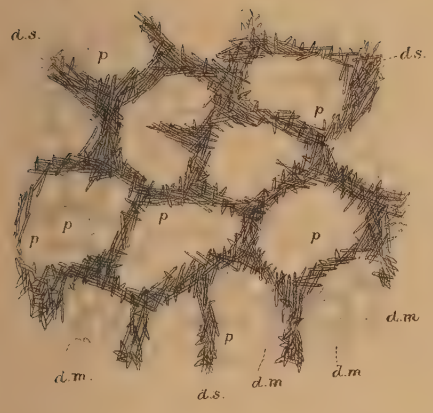

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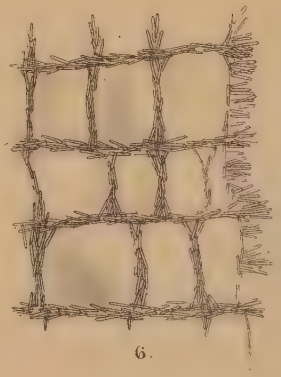

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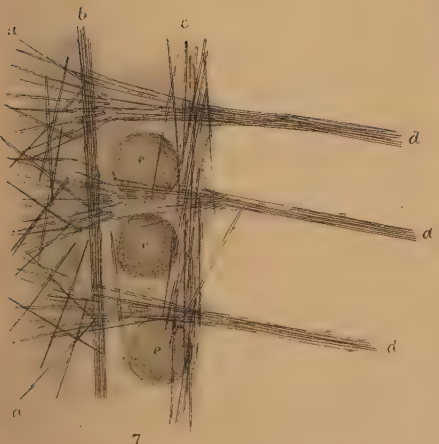

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TYPES OF SKELETON ARRANGEMENT.

PLATE XLVII.

PLATE XLVII.

PAGE

Fig. 1. *Gelliodes licheniformis*, surface section, as seen in alcohol, showing the horny fibre (*h.f.*), ... 48

Fig. 1*a*. Surface section, as seen in Canada balsam, showing the spicules (*s*), while the horny fibre (*h.f.*) is barely visible.

Fig. 2. *Amphilectus ceratosus*, vertical section, showing the horny fibre (*h.f.*), and the arrangement of the spicules, ... 125

Fig. 3. *Myxilla rosacea*, var. *japonica*, vertical section, showing the arrangement of the skeleton; *d.s.*, dermal brushes of spicules; *m.s.*, main skeleton, 130

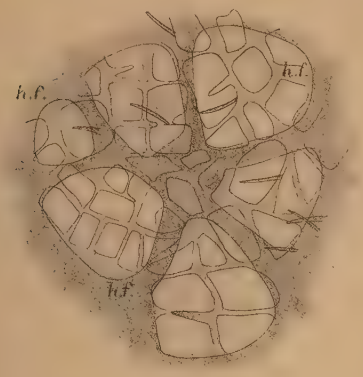
Fig. 4. *Plumohalichondria mammillata*, surface section, showing the arrangement of the dermal skeleton, ... 156

Fig. 4*a*. Vertical section, showing the plumose skeleton fibres (*p.c.*).

Fig. 5. *Clathria lendenfeldi*, section parallel with and near the surface, showing the skeleton arrangement; *h.f.*, the stout horny fibre echinated by spined styli, ... 148

Fig. 6. *Desmacidon* (*?*) *ramosa*, surface section, showing the radiating tufts of oxea, 107

Fig. 7. *Phelloderma radiatum*, vertical section, showing the arrangement of the skeleton; *c*, cortex; *s.f.*, skeleton fibres; *f.b.*, foreign bodies; *i*, isochelæ, ... 114



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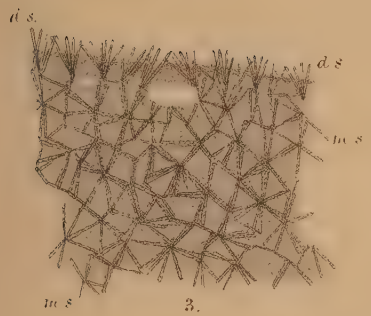

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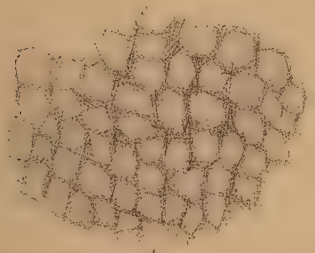

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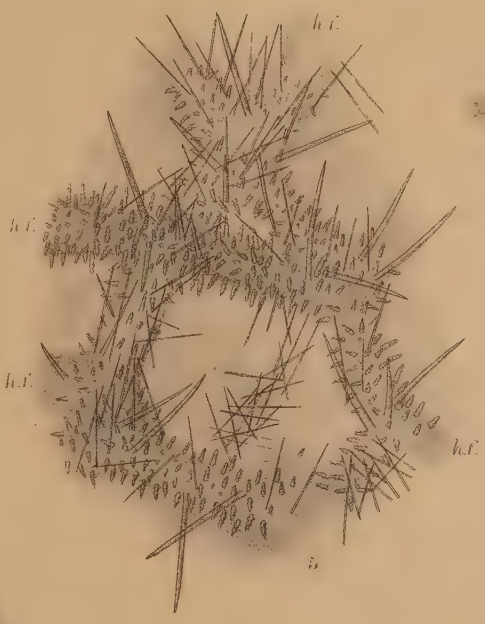

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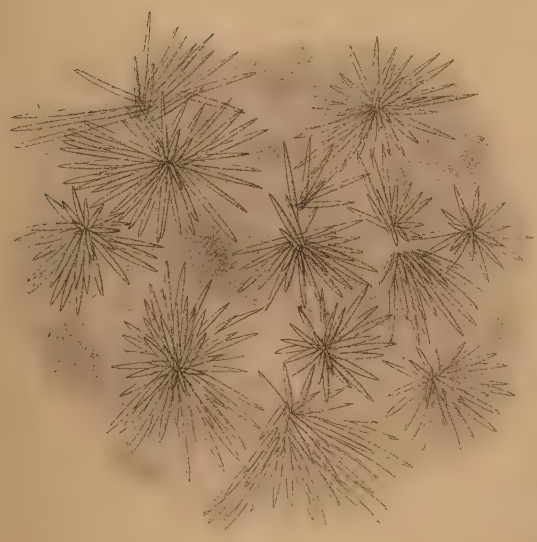

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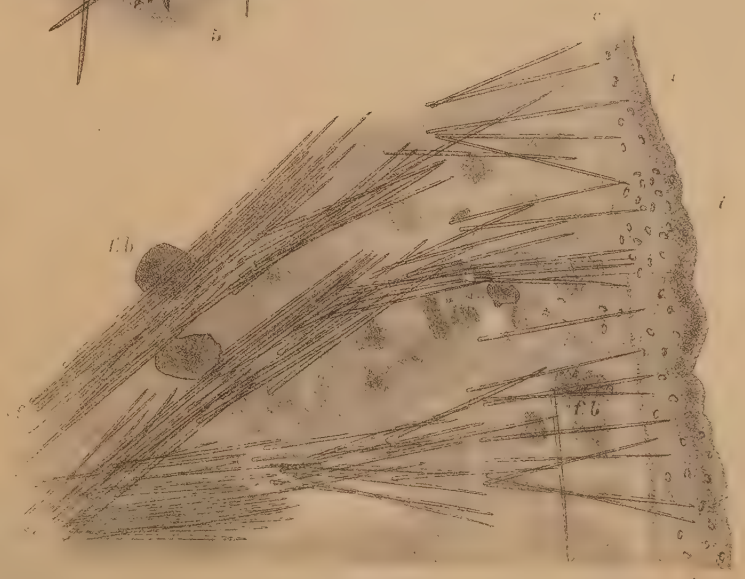

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TYPES OF SKELETON ARRANGEMENT.

PLATE XLVIII.

PLATE XLVIII.

PAGE

Fig. 1. *Esperella lapidiformis*, portion of section of embryo; *a.*, portion of the main mass; *c.*, cap of large, nucleated cells; *n.*, nuclei; *m.*, investing membrane; × 190, ... lii

Fig. 2. *Esperella murrayi*, portion of horizontal section, taken at right angles to the surface; *ect.*, ectosome; *ch.*, choanosome; *p.a.*, crack-like pore-area, seen in transverse section; *s.*, elongated subdermal cavity, seen in transverse section; *i.c.*, inhalent canal, seen in longitudinal section; *e.c.*, exhalent canal, seen in transverse section; *f.c.*, flagellated chambers, lying in the trabeculæ of tissue between the inhalent and exhalent lacunæ (*l.*); *d.s.*, dermal skeleton; *f.*, fibres of the main skeleton; *e*, embryo, in the act of escaping through an exhalent canal; × 13, ... xxx, xxxix, xlvi, &c.

Fig. 2*a*. Portion of the surface of the sponge, showing the crack-like pore-areas, *p.a.*; the pore-bearing dermal membrane has been removed at *p.a'.*, showing the openings of the inhalent canals (*i.c.*) in the floor of the elongated subdermal cavities (*s.c.*); × 2.

Fig. 2*b*. Portion of the dermal membrane from a pore-area; *p.*, the pores; *f.*, the bands of fibrous (muscular) tissue; *n.*, the nuclei of the epidermic cells; *n'.*, the nuclei of the fibrous cells; × 180.

Fig. 2*c*. Portion of a section like that represented in Fig. 2, more highly magnified; comprising only the ectosome surrounding an inhalent canal (*i.c.*); *c.*, darkly staining, amœboid (?) cells, lying in the gelatinous ground-tissue; *t.*, trichodragmata; *w.*, walls of the inhalent canal; *s.*, sigmata, projecting into the lumen of the inhalent canal; × 190.

Fig. 2*d*. Portion of section of the choanosome; *f.c.*, flagellated chambers; *c.*, mesodermal cells; *e.*, epithelial cells lining the canals; × 190.

The spicules are printed in blue.

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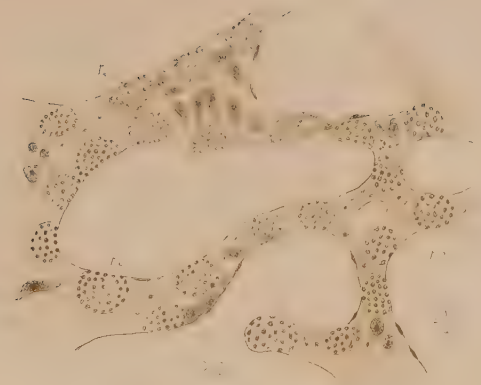

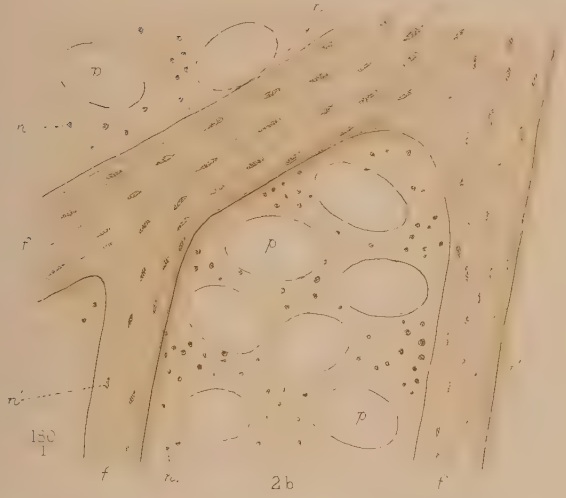

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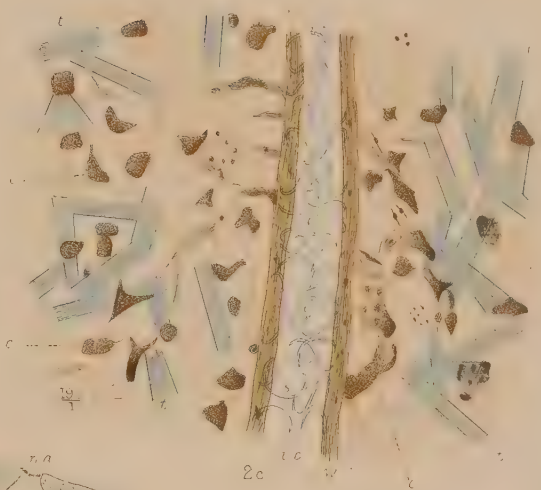

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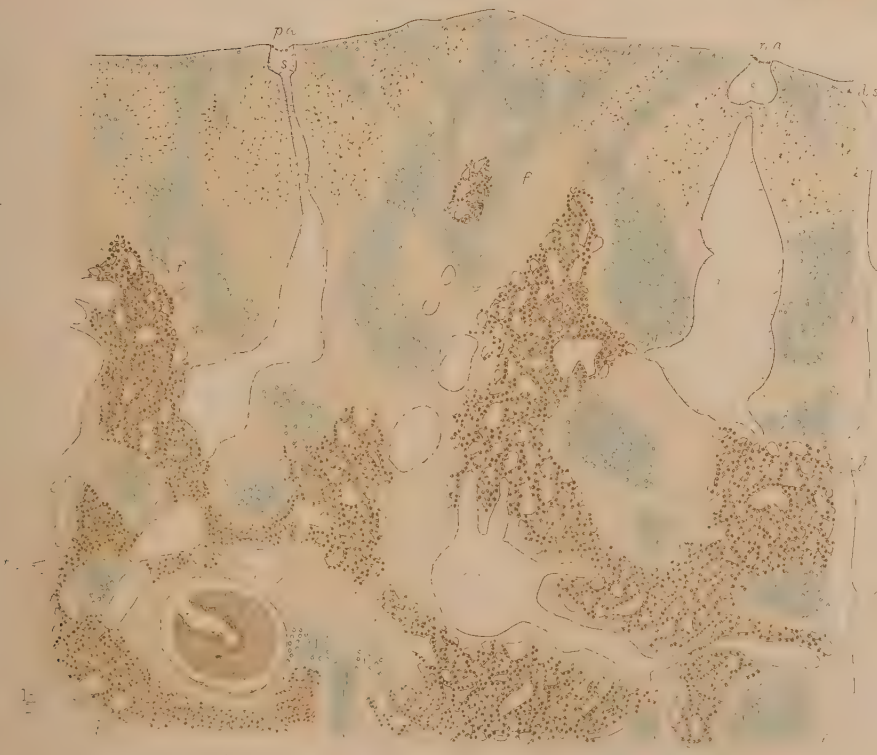
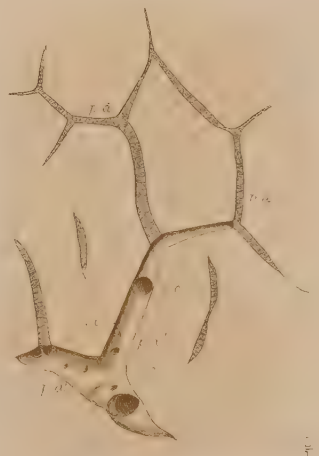




2a

PLATE XLIX.

PLATE XLIX.

PAGE

Fig. 1. *Raspailia tenuis*, transverse section of axis (*a*) and tissues immediately surrounding it; *g.*, granular cells, seen in transverse section; *c.*, globular cells of unknown function; × 190, ... xxii

Fig. 1*a*. Portion of longitudinal section in the same region; *a.*, axis; *g.*, granular cells seen in longitudinal section; × 190.

Fig. 2. *Axinella* (*?*) *paradoxa*, portion of section of choanosome; *i.c.*, inhalent channels; *f.c.*, flagellated chambers; *e.c.*, exhalent channels; *m.c.*, mesodermal cells; × 290, ... xxii, xlvi

Fig. 2*a*. Portion of a band of elongated mesodermal cells (*g.*) found accompanying a skeleton fibre; × 290.

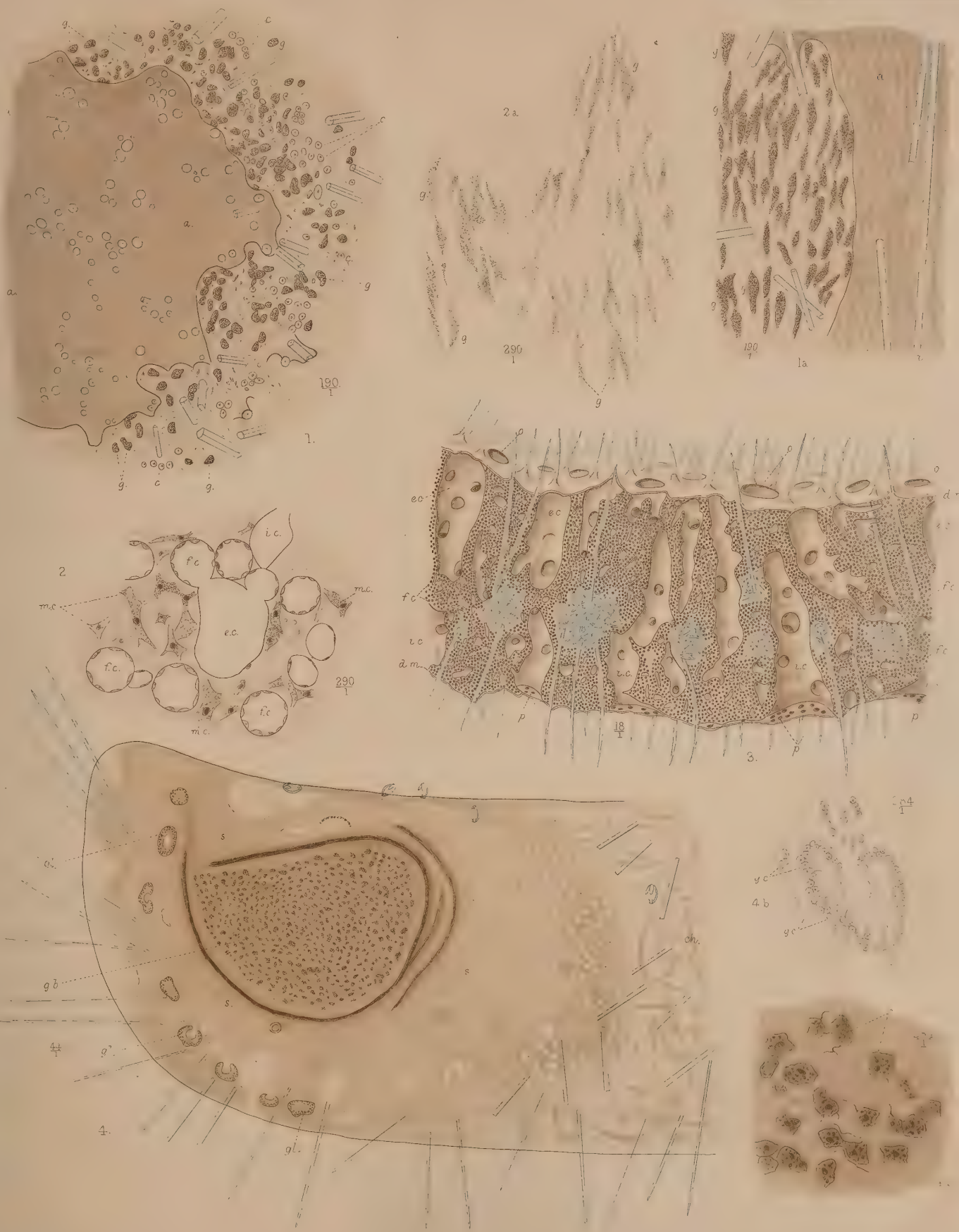
Fig. 3. *Phakellia ventilabrum*, var. *connexiva*, section through a frond, taken at right angles to the surface; *o.*, oscula; *d.m.*, dermal membrane; *p.*, pores; *i.c.*, large inhalent canals, or subdermal cavities; *e.c.*, exhalent canals; *f.c.*, flagellated chambers; × 18, . . xxx, xli, xliii, xlv

Fig. 4. *Cladorhiza* (*?*) *tridentata*, radial, vertical section through one of the marginal, globular bodies (*g.b.*); *gl.*, glandular organs; *s.*, jelly-like secretion (*?*); *ch.*, choanosome; × 44, ... xxxiv

Fig. 4*a*. Small portion of section through the interior of a globular body, showing the irregularly shaped cells (*c.*), lying in the jelly-like matrix; × 284.

Fig. 4*b*. Section through one of the cup-shaped, glandular organs; *g.c.*, the individual cells (or nuclei of the cells) of which it is composed; × 284.

The spicules are printed in blue.



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ANATOMY AND HISTOLOGY.

CLADORHIZA (?), PHAKELLIA, AXINELLA (?), RASPAILIA,

PLATE L.

PLATE L.

PAGE

Fig. 1. *Stylocordyla stipitata*, var. *globosa*, segment of horizontal section; *ect.*, ectosome; *ch.*, choanosome; *p.*, pore; *i.c.*, inhalent canal; *e.c.*, small exhalent canal opening into large exhalent canal; *f.*, fibrous wall of large exhalent canal; × 44, . . xxxii, xliii, xlvi, &c.

Fig. 1*a*. Portion of similar section at the junction of ectosome and choanosome; *g.c.*, glandular (?) cells of the ectosome; *f.t.*, fibrous tissue of the ectosome; *i.c.*, inhalent canals; *f.c.*, flagellated chambers; *e.o.*, opening of a flagellated chamber into an exhalent canaliculus; × 284.

Fig. 1*b*. Small portion of section through choanosome, showing the flagellated chambers.

Fig. 2. *Suberites perfectus*, section at right angles to the surface; *ect.*, ectosome; *ch.*, choanosome; *p.*, pores; *s.c.*, subdermal cavities; *f.t.*, fibrous tissue; × 66, ... xxiii

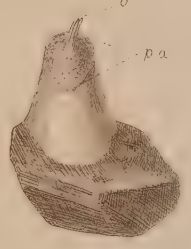
Fig. 2*a*. Fibrous tissue, from a spot where the granular bodies (*g.*) are much more developed than usual; × 284.

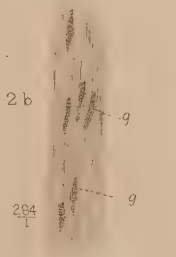
Fig. 2*b*. Fibrous tissue, from a spot where the granular bodies (*g.*) are developed to about the usual extent; × 284.

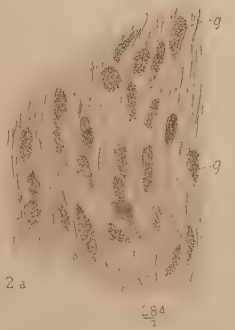
Fig. 3. *Tentorium semisuberites*, external view of the entire sponge, showing *o*, the osculum, and *p.a.*, the single, large pore-area; natural size, ... xxxi, xl, xliii

Fig. 3*a*. Vertical section through the pore-area; *ect.*, ectosome; *ch.*, choanosome; *a.*, outer layer of ectosome; *b.*, middle layer of ectosome; *c.*, inner layer of ectosome; *p.*, pores; *s.c.*, vertically elongated subdermal cavities; *p'.*, narrow canaliculus leading from subdermal cavity into *i.c.*, inhalent canal; × 44.

The spicules are printed in blue.







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ANATOMY AND HISTOLOGY.

SUBERITES, TENTORIUM, STYLOCORDYLA.

PLATE LI.

PLATE LI.

PAGE

Fig. 1. *Latrunculia apicalis* from Kerguelen, section taken at right angles to the surface, through a raised pore-area and an oscular projection; *ect.*, ectosome; *ch.*, choanosome; *p.*, pores, on the top of a raised pore-area; *i.c.*, large inhalent canal; *f.c.*, flagellated chambers; *e.c.*, large exhalent canal, or oscular tube; *o.*, osculum; *d.*, dermal skeleton of discastra; *g.c.*, groups of glandular (?) cells in the ectosome; *e.*, embryos; × 15, . . . xxxii, xxxix, xliv, &c.

Fig. 1*a*. Small portion of section of choanosome, more highly magnified; *i.c.*, inhalent lacunæ; *f.c.*, flagellated chambers; *e.c.*, exhalent lacunæ; *e.o.*, openings of flagellated chambers into exhalent lacunæ; × 284.

Fig. 1*b*. Small portion of section of ectosome, more highly magnified; *d.*, discastra of the dermal skeleton; *f.t.*, fibrous tissue in which the bases of the discastra are imbedded; *v.c.*, vesicular cells; *g.c.*, glandular (?) cells; × 284.

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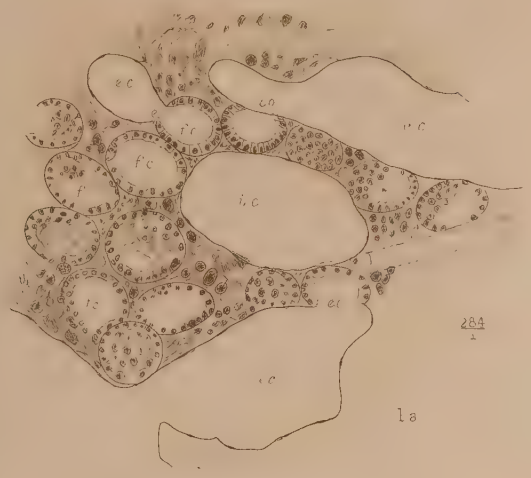

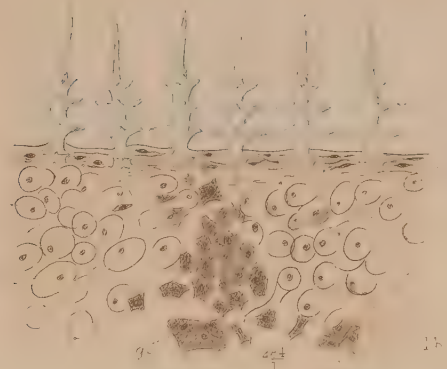

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LATRUNCULIA.

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